Studies of Notiphilinae (Diptera: Ephydridae), I: Revision of the Nearctic Species of *Notiphila* Fallén, Excluding the *caudata* Group

WAYNE N. MATHIS

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ABSTRACT

Mathis, Wayne N. Studies of Notiphilinae (Diptera: Ephydridae), I: Revision of the Nearctic Species of *Notiphila* Fallén, Excluding the *caudata* Group. *Smithsonian Contributions to Zoology,* number 287, 111 pages, 210 figures, 1 table, 1979. —The North American species of the shore fly genus *Notiphila* Fallén were revised. Over 13,000 specimens were examined from throughout the Nearctic Region, and information relating to the natural history of many species occurring in the West was gathered from both field and laboratory studies. Previously used characters were reevaluated; new characters from comparative morphological studies of the male terminalia, from development stages, and from biological and ecological observations were collected. A phylogeny is proposed based on cladistic analysis; and the phenetic relationships were assessed using standard numerical taxonomic procedures. Collectively, all these data were assessed and a classification derived.

Species of *Dichaeta* Meigen are relegated to species-group status, but the name becomes the senior synonym of *Agrolimna* Cresson as one of the subgeneric names. In the subgenus *Notiphila,* three species-groups are recognized, comprising 25 species, of which 14 are new or required new names. In the subgenus *Dichaeta,* 23 species are recognized, 7 are new. Species of the subgenus *Dichaeta* are arrayed into four species-groups. The basis for the classification is discussed and illustrations of the important character states are included. The natural history and zoogeography of the nearctic species are briefly discussed.

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Contents

Studies of Notiphilinae (Diptera: Ephydridae), I: Revision of the Nearctic Species of *Notiphila* Fallén, Excluding the *caudata* Group

Wayne N. Mathis

Introduction

The family Ephydridae comprises a diverse assemblage of predominantly aquatic or semi-aquatic shore flies. As larvae, most are grazers or filter-feeders of organic material, especially algae and bacteria. Others mine foliage of aquatic and terrestrial plants or are saprophytic; the larvae of a few species feed on spider and frog eggs. Many species are uniquely adapted to such inhospitable environments as sulfurous hot springs, highly alkaline or saline lakes, and perhaps most notably, to exposed pools of crude petroleum. In his book *The Natural History of Flies,* Oldroyd (1964:188) wrote:

> Clearly, then, Ephydridae are nothing if not versatile. . . . Evidently we are seeing in the Ephydridae a family of flies in the full flower of its evolution, and as such they offer attractive material for study, not only to the dipterist, but also to the student of insect physiology and behavior.

Shore flies have attracted increased attention during the last ten years, resulting in several significant contributions to our understanding of the family, especially their natural history (Brock, et al, 1969; Busacca and Foote, 1978; Collins, 1975; Deonier and Regensburg, 1978; Scheiring and Foote, 1973; Simpson, 1976; Wirth, 1971). Despite renewed efforts, however, the ephydrid fauna of most geographic regions remains poorly known, systematically and biologically. In the National Museum of Natural History, Smithsonian Institution, alone, Wirth (1968b) estimated that there are over 150 new species of Neotropical Ephydridae awaiting revisionary work and description. Although the Nearctic ephydrid fauna is better known than most, recent revisions of major groups (*Parydra* Stenhammar, Clausen and Cook, 1971; *Hydrellia* Robineau-Desvoidy, Deonier, 1971; *Ephydra* Fallén, Wirth, 1971) still required new species or new name status for approximately one-third of the taxa considered. As a result, meaningful conclusions regarding shore fly biogeography or species diversity, for example, would be premature at present, being limited to taxonomic data that are very incomplete.

To better understand ephydrid diversity and to establish a systematic basis for further study, a taxonomic revision of the North American species of the genus *Notiphila* Fallén was undertaken. This paper presents the results of my study.

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Notiphila is worldwide in distribution, occurring in all faunal realms, although the faunal composition of most areas is still poorly known. Even less is known about the natural history, ecology, and behavior of the genus. In general, *Notiphila* species are associated with permanent aquatic environments where emergent vegetation is plentiful. Typically, the immature stages live underwater in the organic-mud substrate near the shoreline of lakes, ponds, marshes, or wet meadows. Larvae feed on particulate matter such as algae, diatoms, or sapropel, and respire by inserting their caudal spiracles into the aerenchyma of aquatic plant roots to obtain oxygen. The adults of most species are small, generally less than 5 mm.

I selected *Notiphila* for study because of my long interest in Diptera, specifically in the family Ephydridae, and because the present systematic knowledge of this genus is somewhat confused and in need of revision. An improved knowledge of *Notiphila* will result in accurate species identification that will facilitate the acquisition of specific ecological information. This information could contribute to both applied and basic research.

The basic difficulty encountered with our systematic knowledge of *Notiphila* was identified by Ezra T. Cresson, Jr., who wrote the latest synopsis of the North American species in 1946. Cresson prefaced his treatment of the genus with the following comments that outline the problem (1946:231):

> Many species of this genus can be distinguished only after intensive studies of large series from many localities. This difficulty is caused by the numerous apparently stable forms which break down the species limits. The study of the genitalia will probably clear up these problems.

The problem, alluded to by Cresson, is basic to most systematic studies. What are the species limitations (inter- and intraspecific variation), and what is the evidence (biogeographical, morphological, natural history)? The same questions could be asked of higher taxa, particularly of the subgeneric and generic categories.

In response to these questions, an evaluation of the genus was proposed with the following specific research objectives: (1) to examine the male terminalia for potential taxonomic characters; (2) to gather as much natural history and ecological information as possible and to use it in systematic analysis; (3) to update the known distributions of the various species and to correlate this information with possible factors of biogeographic importance; (4) to analyse the phenetic relationships numerically; (5) to gain a better understanding of the phylogeny through a cladistic analysis; (6) to construct a better classification, particularly of the higher categories.

ACKNOWLEDGMENTS.—Numerous persons assisted during all phases of this study, and without their contributions, much of the research could not have been completed.

Financial support was provided through a National Science Foundation grant, a CanaColl Foundation grant during my visit in Ottawa, Canada, and an assistantship from the Department of Entomology, Oregon State University.

The following institutions and curators kindly loaned specimens (an asterisk indicates an institution from which type-specimens were borrowed):

AMNH *	American Museum of Natural History, New York (Dr. Pedro W. Wygodzinsky)
ANSP *	Academy of Natural Sciences of Philadelphia (Drs. David C. Rentz and Selwyn S. Roback)
BM *	British Museum (Natural History), London (Mr. Brian H. Cogan)
CAS *	California Academy of Sciences, San Francisco (Dr. Paul H. Arnaud, Jr.)
CNC	Canadian National Collection, Ottawa (Mr. Guy E. Shewell)
CSU	Colorado State University, Ft. Collins (Dr. Howard E. Evans)
CU *	Cornell University, Ithaca, New York (Dr. L. L. Pechuman)
FSCA	Florida State Collection of Arthropods, Gainesville (Dr. Howard V. Weems)
INHS	Illinois Natural History Survey, Urbana (Dr. Donald W. Webb)
ISU	Iowa State University, Ames (Dr. Robert E. Lewis)
KNSU	Kansas State University, Manhattan (Dr. H. Derrick Blocker)
KSU	Kent State University, Kent, Ohio (Dr. B. A. Foote)
KU *	Snow Entomological Museum, Lawrence, Kansas (Dr. George W. Byers)
LACM	Los Angeles County Museum of Natural History (Drs. Charles L. Hogue and Julian P. Donahue)
MCZ *	Museum of Comparative Zoology, Harvard University (Mrs. Janice C. Scott and Dr. John F. Lawrence)
MSU	Michigan State University, East Lansing (Dr. Roland L. Fischer)
NYSM	New York State Museum, Albany (Dr. M. D. Delfinado)
OHSU *	Ohio State University, Columbus (Dr. Charles A. Triplehorn)

OSDA	Oregon State Department of Agriculture, Salem (Mr. Richard L. Westcott and Mr. Kenneth Goeden)
PSU	Pennsylvania State University, University Park (Dr. Ke Chung Kim)
RNH *	Naturhistoriska Riksmuseet, Stockholm, Sweden (Dr. Per Inge Persson)
SDSU	South Dakota State University, Brookings (Dr. Edward U. Balsbaugh)
UA	University of Arizona, Tucson (Dr. Floyd G. Werner)
UCB	University of California, Berkeley (Dr. E. I. Schlinger)
UCD	University of California, Davis (Dr. R. O. Schuster)
UCR	University of California, Riverside (Mr. Saul I. Frommer)
UG	University of Georgia, Athens (Dr. Warren T. Atyeo)
UMI	University of Michigan, Ann Arbor (Dr. Thomas E. Moore)
UMN	University of Minnesota, St. Paul (Dr. Philip J. Clausen)
UN	University of Nebraska, Lincoln (Dr. Brett C. Ratcliffe)
USNM *	former United States National Museum, collections in the National Museum of Natural History, Smithsonian Institution (Dr. Willis W. Wirth, Systematic Entomology Laboratory, United States Department of Agriculture (USDA), located in NMNH)
USU	Utah State University, Logan (Dr. Wilford J. Hanson)
WNM	Personal collection of Wayne N. Mathis
WSU	Washington State University, Pullman (Dr. William J. Turner)

Plant identifications were provided by Mrs. LaRea D. Johnston, Herbarium, Oregon State University. Stereoscan electron micrographs were taken by Mr. Alfred Soeldner, Oregon State University.

Special thanks are extended to Dr. Paul H. Arnaud, Jr. (CAS), Mrs. Janice C. Scott (MCZ), Mr. Guy E. Shewell and Dr. B. V. Peterson (CNC), and Dr. David C. Rentz (ANSP) for arranging accommodation during visits to their respective museums. I am indebted to Mr. and Mrs. George C. Steyskal, in particular, for graciously hosting me in their home during a visit to the National Museum of Natural History. Mr. Steyskal also spent part of a summer in Oregon, collecting Diptera with me and explaining the morphology of the male terminalia. I also thank Dr. and Mrs. B. A. Foote, who arranged housing and accommodated my wife and me during a field trip to the University of Montana Biological Station, Flathead Lake, Montana. Dr. Curtis W. Sabrosky, Systematic Entomology Laboratory, USDA, assisted with a problem in nomenclature. His efforts are much appreciated.

I also wish to thank the members of my thesis committee, Drs. Norman H. Anderson, Kenton L. Chambers, Robert L. Dennis, Ernst J. Dornfeld, and Paul Oman. I am especially grateful and indebted to Dr. John D. Lattin for his constant encouragement, time, and thoughtful consideration of many problems that arose during the course of this study.

In addition, I thank Miss Anne Halpern for typing the manuscript, Miss Hollis B. Williams for preparing all of the maps, Mr. L. Michael Druckenbrod for the habitus (Figure 1), Mr. George Venable for photograph retouching, and Drs. Richard H. Foote, Willis W. Wirth, Terry L. Erwin, and Wayne E. Clark for reading part of or the entire manuscript.

Materials and Generalized Procedures

During this study, over 13,000 North American specimens were examined. In addition to my personal collection, specimens were borrowed from most major collections in the United States and Canada. Collections, curators, and acronyms are listed in the Acknowledgments section. I also examined specimens of many extralimital species and the type(s) of all nominate species reported to occur in North America, with the exception of those for *N. uliginosa* and *N. riparia*. The syntypes of the former have not been located but are presumably in the National Collection of Ireland. The syntypes of *N. riparia* are in the Museum National d'Histoire Naturelle, Paris. I did examine named European specimens of *N. uliginosa*. Where appropriate, lectotypes were designated as indicated in the text.

Label data for each specimen were recorded, condensed, and organized alphabetically under each species according to country, state or province, county, etc. State or provincial localities that could not be located or that were too large to be included in one county were listed before the county label data. Names of collectors were omitted and collection dates were summarized. However, label data accompanying each examined holotype were recorded as given; in some cases, clarifying or more complete information is included parenthetically. Distribution maps are also given for species for which adequate locality data were available.

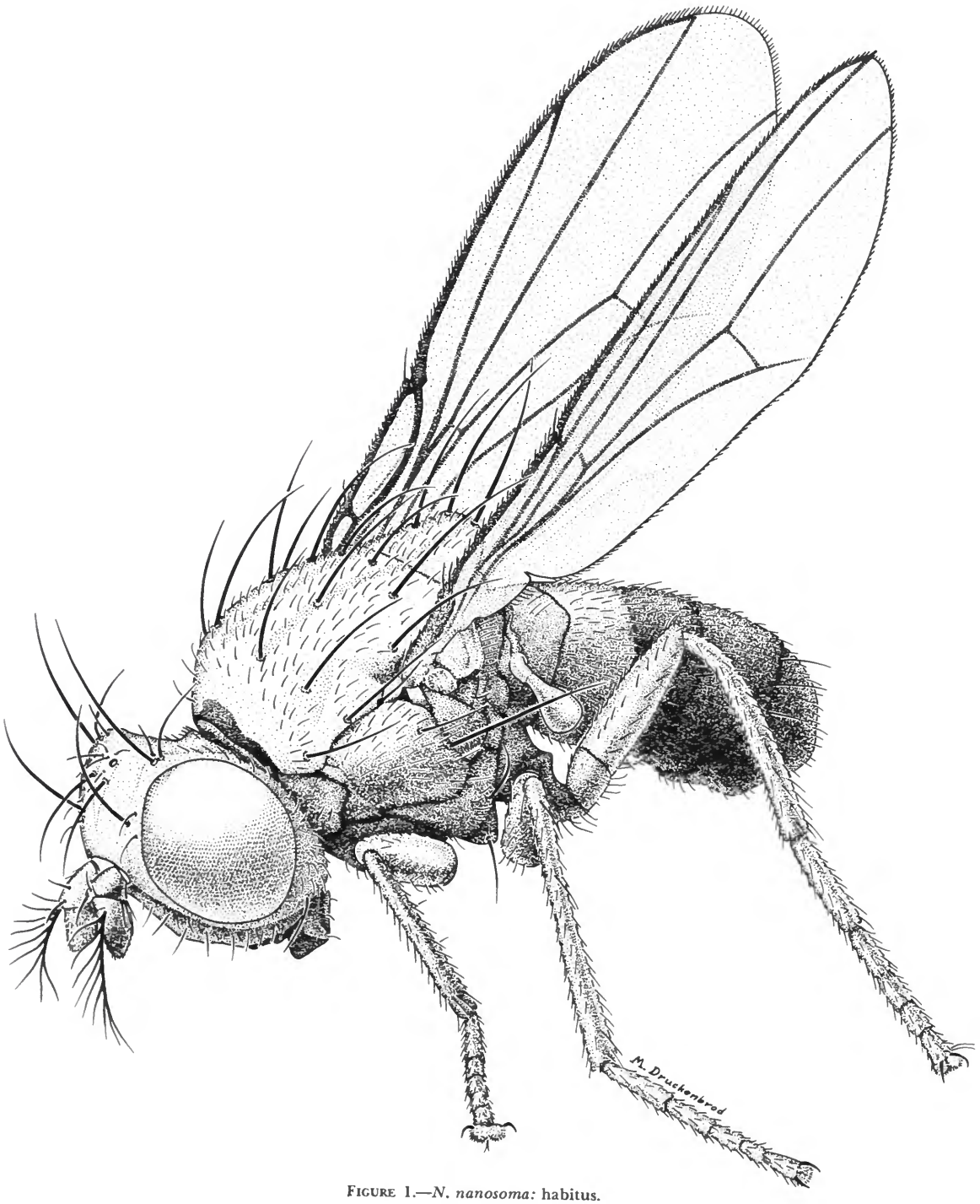


FIGURE 1.—*N. nanosoma:* habitus.

All specimens I was able to identify to my satisfaction were individually labeled with my determination labels. In a few cases, single female specimens were identified to species-group only. Previously undescribed species were described when a male was present, despite its condition.

Natural history information was collected from both field and laboratory observations. All rearing was done in the laboratory and was limited to the beginning and final instars (eggs to first-instar larva; third-instar larva to adult). Field-collected third-instar larvae and puparia were placed in enamel pans or petri dishes that had lantern chimney enclosures and cotton substrates. The pans or dishes were kept in Sherer constant temperature cabinets at a temperature of approximately 21° C. Humidity was maintained by keeping shallow pans filled with water in the bottom of the cabinet. A photoperiod regime of 12 hours dark/12 light was used.

Intensive study of the male terminalia required further preparation. Preparation of the male terminalia entailed removing the abdomen and treating it with a hot 10% solution of sodium hydroxide for approximately one minute to remove extraneous tissue, then rinsing the structures in tap water. The genitalia were then transferred to glycerin for dissection and study. The abdominal structures, including the dissected genitalia, accompany the appropriate specimen in an attached plastic microvial (pinned by the stopper).

Illustrations were drawn using a Wild Mark 5 stereomicroscope equipped with a drawing tube. A doubling lens was attached to the microscope when illustrations of the genitalia were prepared to enlarge the initial drawings. The figures were drawn on grid paper and were later inked on mylar drafting film or velum. Unless otherwise indicated, all illustrations were drawn to the same scale.

Most measurements were taken using an American Optical filar micrometer attached to an American Optical Spencer stereomicroscope. Various magnifications were used depending on the structure being measured: 90× for head parts, 45× for thoracic and abdominal structures, and 15× for the total length. Wing measurements were taken from enlarged negative prints made using a print-producing microfilm reader. The wings and prints were prepared as follows: A wing was removed, placed in xylene for about one minute, and slide-mounted using a synthetic Canadian balsam; after curing in a warm oven for approximately one week, the slide was taped over the bottom lens of a 3-M Filmac 400 microfilm reader-printer and a negative print was taken at the desired magnification. A millimeter ruler was then used for taking the appropriate measurement. Although time-consuming, this procedure insured accurate and consistent measurement of a flat wing.

Species descriptions are composite and purposefully brief; for the most part they summarize specific differences or additions not found in the more detailed generic, subgeneric, or species-group descriptions. The diagnoses will differentiate the species from similar taxa. Polymorphic or polytypic variation plus any pertinent natural history data are included in the discussion of each species.

Classification and Phylogenetic Methods

Members of *Notiphila* are bisexual, and I have generally ascribed to Mayr's biological species definition (1969). However, very little direct information regarding gene flow or reproductive isolation is available, making the nonarbitrariness of Mayr's definition difficult to demonstrate, particularly when populations are geographically distant. The presence or absence of interbreeding must therefore be inferred from comparative morphology (in the broad sense to include color), coupled with field data on ecology, life history, geographic distribution, etc. Confirmation of inferred "species" with field data strengthens this basis for recognizing species, and in the absence of field data, greater confidence can be given to the inferred basis by extrapolation. For practical purposes, the only available data in the present study are from adult morphology, distribution, and in a few instances ecological data.

Traditionally, shore fly species concepts were founded on external adult morphology. More recently, the diverse structures of the male and female genitalia have aided substantially in species recognition (Andersson, 1971; Clausen and Cook, 1971; Cogan, 1968; Dahl, 1972; Deonier, 1971; Mathis, 1975, 1977a, 1977c, 1978; Miyagi, 1966, 1977; Steyskal, 1970; Wirth, 1948, 1964, 1968a, 1971, 1975). In the case of *Notiphila*, genitalic structures appear to be very reliable and correlate well with other external characters. When I dealt with speci-

mens from allopatric populations, differences in genitalic structures were the main criteria for species recognition.

The basis for constructing the phylogeny of the higher categories is cladistic, sensu Hennig (1966). Characters were assessed within the subfamily to determine transformation series and the putative monophyletic lineages were elaborated as supportive, apotypic character states were discovered.

The quantitative taxonomic procedures used are outlined in Sokal and Sneath (1963) and Sneath and Sokal (1973). Forty-eight OTU's (operational taxonomic units) and 49 characters were selected, quantified, and numerically assessed. An exemplar was chosen to represent each OTU. Thirty-three quantative and qualitative multistate characters were standardized; 16 two-state characters were left as 0's or 1's. The effect of size was removed by expressing values of size characters as ratios of the total wing length. Wing length is the largest size character for most OTU's, making most ratios a value between unity and zero.

Estimates of resemblance were evaluated using Manhattan and Euclidean distance coefficients and the Pearson product-moment correlation coefficient. Several agglomerative, hierarchical clustering techniques were employed and the results are summarized graphically as phenograms.

Only agglomerative algorithms were used in clustering the data. Agglomerative clustering techniques are more frequently employed (frequently the only algorithms available), although they are less reliable as larger groups of the original separate entities (OTU's) are formed. However, the initial species groupings, as clustered, should more accurately reflect their phenetic relationships. Ideally, both agglomerative and divisive algorithms should be employed in the construction of a classification. Divisive techniques are better for delimiting larger groups, but tend to become less accurate as smaller subsets of the original group (all OTU's) are formed.

Most of the calculations were performed by a CDC-3300 computer at Oregon State University. The computer was programmed with *MINT, a program converted from an IBM system program developed by Dr. F. James Rohlf.

Most of the taxonomic decisions were resolved from results of the cladistic analysis. Contrary to a stated aim of numerical taxonomy (Sneath and Sokal, 1973:11), I did not find the operational procedures of quantitative phenetics any more objective than the methodology of "conventional taxonomy." The selection of OTU's, characters and character states, coding or scaling procedures, similarity estimates, clustering techniques, etc., are obviously subjectively chosen and the resulting conclusions can only mirror these choices (biases). The following quote from Sneath and Sokal (1973:146) is an example:

> But when all is said and done, the validation of a similarity measure by the scientists working in a given field has so far been primarily empirical, a type of intuitive assessment of similarity based on complex phenomena of human sensory physiology.

Discussion of Taxonomic Characters

Characters considered in this study are from all body tagma and have been quantified where appropriate. Ratio values are based on an average of five specimens from different localities, if available.

HEAD.—*Eye Ratio:* Eye height/eye width; measurements are taken from the eye in lateral view (Figure 2). This character is good for taxa at the species level and is more frequently used to distinguish species of the subgenus *Notiphila*.

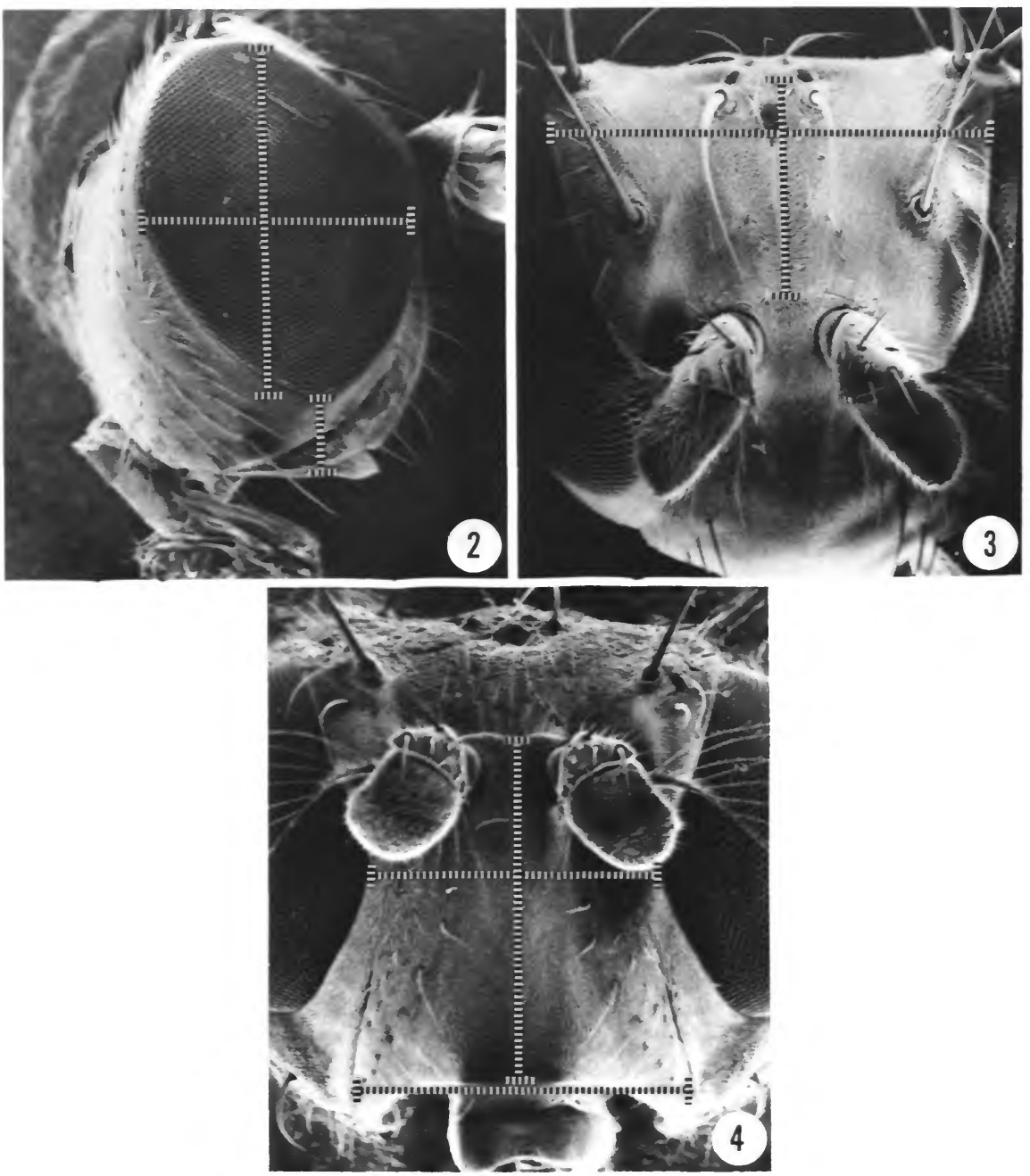
Eye-to-Cheek Ratio: Eye height/genal height. Measurements are taken from the head in profile (Figure 2). Like the eye ratio, this character has been found to be good only at the species level.

Postfrons Ratio: Frontal height/frontal width. Width is measured as the distance across the frons between the median margins of the eyes immediately anterior to the anterior ocellus; height is the distance from the anterior margin of the frons to the posterior pair of ocelli (Figure 3). This ratio is particularly good for distinguishing taxa belonging to the *adusta* group.

Prefrons Ratio: Face height/face width. Height is measured between the oral margin of the dorsum of the frontal suture; width is the narrowest distance between the eyes across the face (Figure 4).

Paravertical Bristle: The length and diameter of the paravertical bristles were previously overlooked as a character, although it can be readily used to separate some species-groups and species. A comparison of these bristles with the postocellar and/or genal bristles is convenient.

Fronto-orbital Setae: This character is the num-



FIGURES 2–4.—*N. quadrisetosa:* 2, head, lateral aspect (dashed lines = where measurements taken of eye height, eye width, and genal height); 3, head, anterodorsal aspect (dashed lines = where measurements taken for postfrons ratio); 4, head, anterior aspect (dashed lines = where measurements taken for prefrons ratio).

ber and size of the small, proclinate, fronto-orbital setae located laterad of and slightly anterior of the much larger reclinate bristle. Most specimens of the subgenus *Dichaeta* have two well-developed setae, whereas those of the subgenus *Notiphila* have one, two, or lack distinguishable setae.

Color of Antennal Segments: This character is more frequently used in the subgenus *Notiphila* and is best used as a secondary diagnostic attribute due to considerable variation.

Aristal Branches: Cresson used this character extensively and I have generally found it useful for species recognition. Care should be taken, however, in attributing undue emphasis to this character because of variation. Poorly preserved specimens frequently have damaged or broken aristal branches.

Facial Color: The value of this character varies with the species, depending on the degree of variation exhibited. But for many species, the facial coloration is diagnostic, being relatively constant and consistent.

Facial Setae: This character is based on the number, degree of development, and relative length of the setal series. Difficulties sometimes arise using this character because differences between character states are slight in many cases. I have used facial setae as a key character only where extremes are evident.

Color of Maxillary Palpus: The maxillary palpus is generally pale orange to yellow or dark brown to black. This character is generally good at the subgeneric level with a few notable exceptions.

THORAX.—*Coloration of Mesonotum:* Usually the mesonotum is more darkly colored than the pleural areas, and the degree of contrast is often a useful character. The color of the mesonotum by itself is also a reliable character for a few species.

Mesonotal Stripes: This is actually a composite of several characters. Many species have a distinct to fairly distinct median stripe that bifurcates posteriorly. Specimens of the *adusta* group and of a few other species have this and/or additional paired stripes laterad of the median line. These darker stripes are used extensively in recognizing species belonging to both subgenera, especially those of the *adusta* group.

Scutellar Margins: The lateral margins of the scutellum of many species are dark brown to black and distinctly contrast with the coloration of the dorsum. Contrast in coloration is best seen from a posteroblique angle. This character is useful in separating specimens of the subgenus *Notiphila.*

Mesopleural Maculation: The mesopleuron of specimens of several species have a maculate area that is variously shaped and distinct from the surrounding coloration. In a few species there is considerable variation in the degree of maculation and in many species the mesopleuron is immaculate.

Midtibial Dorsal Bristles: The number of midtibial dorsal extensor bristles distinguishes members of *Notiphila* from those of most other shore fly genera (Figure 5). The number of bristles also serves

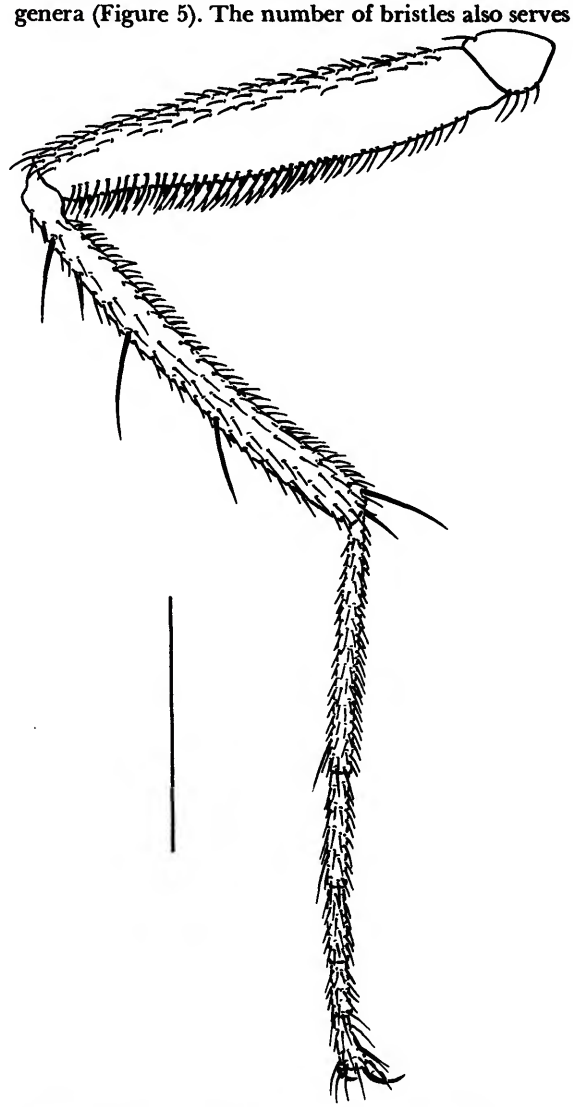


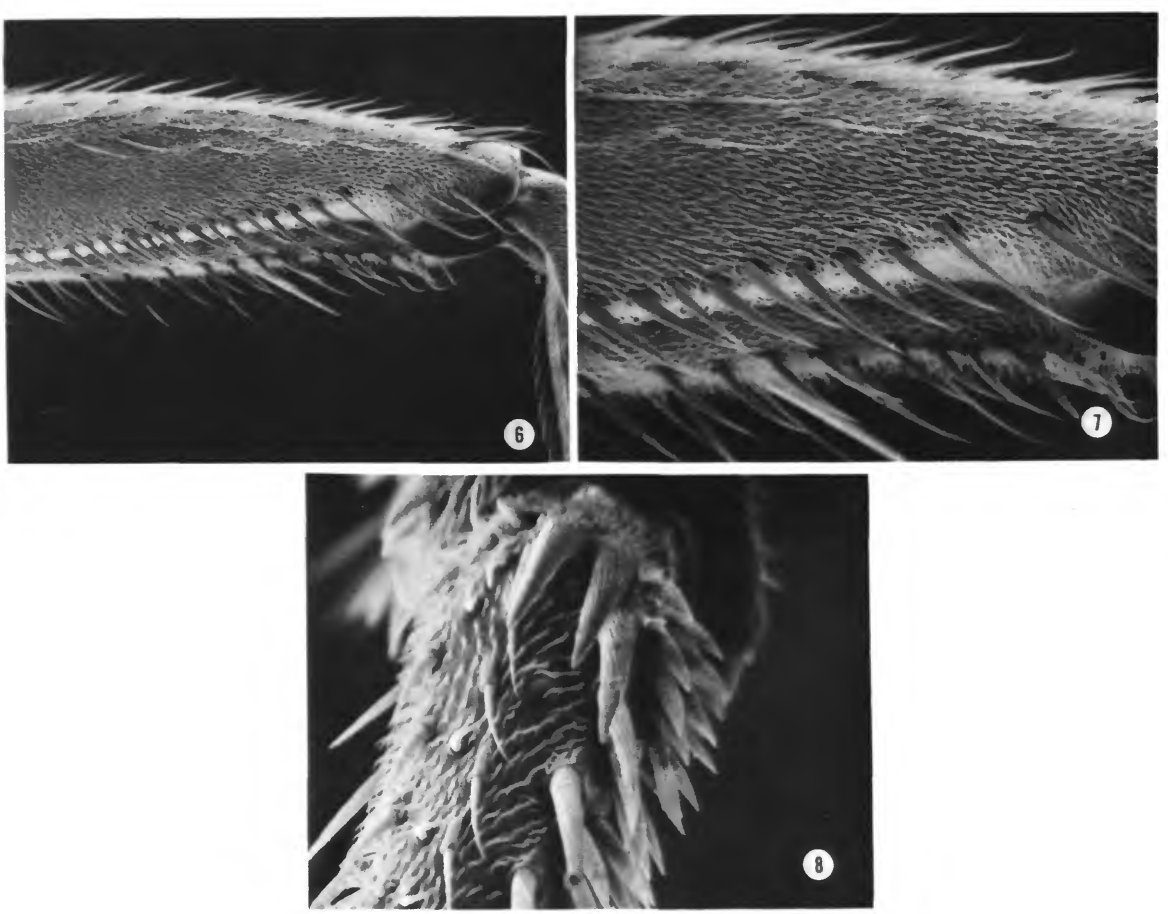
FIGURE 5.—*N. carinata:* leg, posterior aspect (scale 0.5 mm).

to distinguish members of the subgenera. These bristles are often broken; on occasion, an aberrant specimen of the subgenus *Notiphila* is found with four bristles or of the subgenus *Dichaeta,* aside from specimens of the *caudata* group, with three.

Midfemoral and Midtibial Setal Combs: Members of most species of the subgenus *Notiphil*a possess a comblike row of setae along the posteroventral margin of the middle femur (Figures 6–7). Most of the same specimens also have a distinctive row of short setae along the ventral surface of the midtibiae. This is a sexually dimorphic character, being restricted to males. The function of these structures is not known.

Coloration of Tibiae and Tarsi: Although somewhat variable, the general coloration of the tibiae and tarsi are good characters for many species, especially in the subgenus *Dichaeta.* Caution should be exercised, however, in relying on these characters alone, due to considerable variation within some species.

Setal Fascicle of Hind Basitarus: The setal fascicle is a distinctive group of four to five closely-set setae that generally project at an oblique angle from the ventral surface of the basitarsus near its base (Figure 8). Often one to four of these setae are dark brown to black, contrasting with the surrounding setae. This character seems to be more useful in the subgenus *Dichaeta.* Many species with dark-colored basitarsi have a pale-colored setal fascicle.



FIGURES 6–8.—*N. erythrocera:* 6, middle femur and posteroventral comb of bristlelike setae; 7, enlargement of Figure 6; 8, hind basitarsus and setal fascicle, ventral aspect.

Wing Ratios: Several ratios are used, although they are of limited value due to variation. All measurements are straight-line distances. The wing ratio is wing width/wing length; the width is measured at the widest point and length is the distance between the base of the second basal cell and the wing tip. The costal vein ratio is costal vein length between R_{2+3} and R_{4+5}/length between R_1 and R_{2+3}. The M_{1+2} vein ratio is M length between the posterior crossvein and wing margin/length between anterior and posterior crossveins.

ABDOMEN.—*Maculation Pattern:* Most species have a fairly constant maculation pattern that is darker in coloration than the surrounding background. Members of the subgenus *Dichaeta* are most often fasciated with a dark band across the anterior portion of the exposed terga. The fascia are usually interrupted by a median stripe that is lighter in color. Specimens of the subgenus *Notiphila* are more variable, having extensive guttate markings, fascia, small geminate spots, or are immaculate.

Setation and Conformation of Fourth and Fifth Abdominal Terga: Males of two species-groups of the subgenus *Dichaeta,* the *furcata* and *caudata* Groups, have the last two exposed abdominal terga developed with *Dichaeta*-like bristles and conformation. The fifth tergum projects posteriorly into a narrowed process, which varies considerably in size with the species. Further, the posterior margin of the fourth tergum bears several large bristles and the process of the fifth tergum terminates with one to three stout bristles.

Abdominal Ratio of Males: Abdominal length/width. Both distances are measured from a dorsal view and are the maximum distances.

Tergum V/IV Ratio in Males: Length of the fourth tergum/length of fifth tergum. The ratio is correlated with the fifth tergum ratio and is diagnostic of some members of the sugenus *Notiphila.*

Tergum V Ratio in Males: Tergum V width/length. Like the above ratio, this one is reliable for distinguishing some members of the subgenus *Notiphila.*

Male Terminalia: There are several characters of the male genitalia that are useful at all levels. The characters I have used are the following: (1) the presence or absence of a ventral epandrial process and its conformation; (2) the shape of the basiphallus; (3) the degree of development of the surstyli and their shape; (4) the degree of development and shape of the hypandrial process; and (5) the type of hypandrial receptacle. See the subgeneric descriptions for a more detailed assessment of the male terminalia morphology.

Female Terminalia: The shape of the ventral receptacle and the extent of sclerotization of the terminalia in general are good at the subgeneric level and in some cases at the species-group level.

Historical Review

Notiphila, a Greek combination of *notios* ("wet" or "damp") plus *philos* ("friend") was proposed by Fallén (1810) as a genus of the family "Hydromyzides." No species were included, no type-species was designated, and the family name is not currently in use. In a subsequent revision, Fallén (1813) described 15 species, although only the first two, *N. caudata* and *N. cinerea,* remain in the genus today. The latter species was fixed as type-species by Westwood (1840).

Since its proposal, the conceptual and nomenclatural history of *Notiphila* has fluctuated considerably. Typical of common and widely-distributed taxa, many species originally included in *Notiphila* were later transferred to other shore fly genera and in some cases, to genera of other families. Frequently, a genus of one author became a subgenus of another, and because *Notiphila* was described relatively early in the history of nomenclature, it was the name under which several of these "genera" were combined. This pattern of development resulted in an inordinate number of species epithets used in combination with *Notiphila,* subsequently resulting in the formation of homonyms. Most of the early treatment of *Notiphila* consisted of brief listings and diagnoses of described taxa, summarizing the work of previous authors, plus descriptions of new taxa. Nearly all of these works dealt with the palearctic fauna (see Becker, 1926, for references).

With minor exceptions, the same descriptive trend continued for 50 years until Loew (1860) published an important study on European Ephydridae, establishing a classification that most students of the family accepted for the remainder of the century. Loew's classification divided the family into "sections" that were later recognized as subfamilies. *Notiphila* became the nominate genus of the "section" Notiphilina and was restricted in

concept to that of present-day usage. Two years later, in a monograph of North American shore flies, Loew (1862) used this classification for *Notiphila* and described five new species. Later, Loew (1872, 1878) named four additional species of which only two, *N. unicolor* and *N. vittata,* have required nomenclatural changes in this study.

Aside from Loew's contributions, only five other North American species were described during the nineteenth century: Haliday (1839) described *N. uliginosa* from European specimens (this species is now known to have a holarctic distribution); Walker (1853) described *N. solita* and *N. transversa* from specimens in the W. W. Saunders collection; Thomson (1869) named *N. quadrisetosa* from specimens collected in California; and Williston (1893) described *N. decoris* from a single female specimen collected at Panamint Springs near Death Valley, California.

Following Loew's monographic study in 1862, the next major paper treating the North American *Notiphila* fauna was a revision by Cresson (1917). That paper was among the first of several publications over a period of four decades in which Cresson set forth a classification and sizable portion of the descriptive work of the world's shore fly fauna. His 1917 study of *Notiphila* was particularly noteworthy, being comprehensive for the fauna of the Western Hemisphere. In it, Cresson erected two subgenera, *Notiphila* and *Agrolimna,* and recognized 27 species or varieties, of which 16 were new. Although Cresson did not have the opportunity to examine types of many of the previously described species, his species concepts and names have, with few exceptions, remained unchanged to the present.

Cresson described two additional species in 1940; and in 1946 he published a synopsis of the genus as Part III of a synoptic series treating nearctic Ephydridae. Included in the latter paper is a tribal classification and a key to North American species. *Notiphila* became the nominate genus for the tribe Notiphilini, which then included three other genera: *Dichaeta* Meigen, *Oedenops* Becker, and *Paralimna* Loew. In a study on the African species of this tribe by Cogan (1968), Notiphilini was expanded to include *Dryxo* Robineau-Desvoidy and *Karema* Cresson. I have relegated the species included in *Dichaeta* to a species group, and *Dichaeta* becomes the senior synonym of *Agrolimna* as a subgeneric name.

During the present century, new species of North American *Notiphila,* in addition to those in Cresson's revisions (1917, 1940), were proposed by four authors: Coquillett (1902) described *N. furcata,* although he initially assigned this species to the genus *Dichaeta;* Jones (1906) named *N. varia,* which was later found to be conspecific with *N. erythrocera* (Cresson, 1917); Curran (1930) described *N. latelimbata* from a female specimen collected in New York, the status of which is still uncertain; and Wheeler (1961) described *N. hamifera* from specimens collected in Oak Creek Canyon, Arizona. Jones' (1906) new species descriptions were published as part of a catalog, key, and bibliography of Ephydridae.

Prior to Jones' publication, the Nearctic species of *Notiphila* had been cataloged three times. Baron Osten Sacken compiled the first two in 1852 and 1878. Osten Sacken's first catalog listed only one name currently in use, *N. solita,* but all of the names in the second catalog were used in a recent catalog (Wirth, 1965). In 1905, Aldrich published the third catalog of North American species.

Two regional faunastic studies considered species of *Notiphila* relatively recently: Wirth and Stone (1956) for California and Deonier (1964) for Iowa. The former includes some ecological data and a generic key to the larvae of many ephydrids. Other papers dealing with various aspects of the ecology or natural history of nearctic *Notiphila* are those of Berg (1950), Deonier (1965), Eastin and Foote (1971), Scheiring and Foote (1973), Busacca and Foote (1978), and Deonier, et al, 1978 [1979].

Use of characters of male terminalia is a relatively recent innovation in the study of Notiphilines. Miyagi (1966), in a review of Japanese species of *Notiphila,* was the first to use characters of the male terminalia. Two years later, Cogan (1968) revised African Notiphilini, incorporating male terminalia characters, particularly in his characterization of the higher categories. More recently, Dahl (1972) included illustrations of the ventral processes of the male epandrium in a review of the *Notiphila* species of Afghanistan. These studies substantiate Cresson's early proposal of two subgenera and demonstrate the usefulness of male genitalia at the species level, confirming Cresson's recommendation in his 1946 synopsis of the genus.

Natural History

Specimens of *Notiphila* are common inhabitants of wetland environments where emergent vegetation is abundant. Larvae and pupae live in the submerged, mud substrate where they are closely associated with roots of various aquatic plants, presumably to obtain oxygen. Most species are innocuous, although Koizumi (1949) reported that larvae of *N. sekiyai* Koizumi were a serious pest to rice roots in Japan.

The ecology and natural history of *Notiphila* adults have been studied by Dahl (1959) for northern European species, and by Deonier (1964), Scheiring and Foote (1973), Deonier, et al, 1978 [1979], and Busacca and Foote (1978) for Nearctic species. These authors observed that most species are found in sedge-meadow or marsh-reed habitats, but a few species occur in floating-vegetation or limnic-wrack habitats.

Dahl (1959) reported that many *Notiphila* species normally have rather restricted habitat preferences, but it is not uncommon to collect adults of several species at one site (Busacca and Foote, 1978). Certain species in particular frequently occur together. While collecting along the banks of the Galinas River in San Miguel County, New Mexico, I swept through an area approximately 50 m by 10 m and found eight species. Seven species belonged to the subgenus *Dichaeta* (*N. atripes, N. macrochaeta, N. decoris, N. sicca, N. aenigma, N. olivacea, and N. deserta*) and the eighth was a member of the subgenus *Notiphila* (*N. erythrocera*). How these species are partitioning the habitat is an interesting but largely unanswered question. However, Busacca and Foote (1978) noted a good correlation between numbers of *Notiphila* species and plant diversity, and Deonier, et al, 1978 [1979], found that larvae of *N. carinata* are specific to the roots of water willow (*Justicia americana* (L.) Vahl).

Although *Notiphila* adults are capable flyers, significant dispersal is probably accomplished passively. Glick (1939) collected wind-blown adults of the *caudata* group at altitudes of up to 2000 feet above the land's surface. Adult flight behavior is not characterized by a great deal of activity. Within a marsh or meadow where vegetation is dense, flight is often a short, almost hoplike movement to the next sedge. Adults often pause for extended periods on a *Carex* culm, for example. Busacca and Foote (1978) observed that adults of *N. aenigma* and *N. solita* normally rested head downward within 15 cm of the water's surface where the humidity was relatively high but where direct sunlight could be avoided. Dahl (1959) noted that adults have tarsi adapted for climbing on the vertical shafts of cattails and other reeds.

Males seem to spend most of their time trying to locate receptive females for mating. Adults of both sexes will often congregate on the white fabric of a collecting net that is laid against and among the emergent vegetation. In these situations, I have observed *Notiphila* males of various species attempting to mate with almost any small, moving fly that has momentarily stopped on the netting.

Dahl (1959) recognized six phases in shore fly mating behavior: Initiation, posturing, restimulation, mounting, insemination, and dismounting. These designations were largely borrowed from studies on *Drosophila* behavior (Spieth, 1947) and the studies of both Dahl and Spieth should be consulted for definition of each stage. My observations were made from laboratory-caged adults, and I have not categorized the events into the phases indicated above.

The following mating behavior observations were made from adults of *N. quadrisetosa.*

Several mature, virgin males and females were introduced into rearing chimneys and subsequent matings observed. Mating attempts occurred soon after both sexes were brought together. Before mounting was attempted, a male would approach a potential mate slowly. Males were observed attempting to mount both sexes of the same and other species, suggesting perhaps that females are the discriminating sex. Many mounting attempts by males on females were rejected. Females rejected males by quickly scraping across the dorsum and sides of her abdomen with her hind legs, breaking the mounting grasp of the male. Males grasped responsive females around the abdomen with the middle and hind legs, while the front legs are held over the female in a perched position. The tarsal claws of the front legs of the male grasp the base of the female's anterior wing margin. A mounted female's wings are slightly parted at approximately a 45° angle and upturned. When slight movements were made by the mounted female, the male responded by stroking his front tarsi

across her mesonotum. The middle and hind tarsi also stroked the sides and venter of the female abdomen intermittently. Stroking of the female's abdomen by the middle and hind tarsi sometimes was accompanied by the stroking motions of the male front tarsi, but often the abdomen-stroking did not occur simultaneously. At times, the female would preen herself while *in copula*, especially her head and antennae. After copulation was initiated, a second male would sometimes attempt to mount the same female. Often the second male would grasp the copulating pair and remain with them during most of the copulation period. A single female was observed to mate more than once. While *in copula*, a pair is not easily disturbed. Occasionally, the mounted female would lose her grasp of the substrate and fall to the bottom of the rearing chamber, but the pair would usually remain *in copula* while the female uprighted herself and regained her grasp of the substrate. Most matings lasted 10 minutes or less, but a few were timed at over 15 minutes.

Gravid females are selective in choosing oviposition sites. Considerable time is spent probing, first with the mouthparts and then with the exended ovipositor before a site selection is made. Normally, females choose concealed sites for oviposition, such as a split or break in a dried grass culm or any crevice where eggs would be hidden and protected. Busacca and Foote (1978) and Deonier, et al, 1978 [1979], found that the inner surfaces of both living and dead leaves, often bent over, on or near the water or mud surface, were utilized as oviposition sites by females of *N. aenigma* and *N. carinata*. Dahl (1959), however, stated that *Notiphila* females insert eggs into plant tissue. I have found that eggs of *N. quadrisetosa* are generally laid in clusters, each egg usually parallel to the others. In laboratory rearing chimneys, eggs are sometimes laid on the sides of the glass and frequently through the fabric mesh covering the open top. Busacca and Foote (1978) observed that females of *N. aenigma* mature at least two complements of eggs, those of newly emerged females and a second batch several days later. Deonier, et al, 1978 [1979], noted that one of two females of *N. carinata*, collected in September, laid 35 eggs in a 24-hour period and the other laid 27 eggs in a 72-hour period.

The immature stages of *Notiphila* are much more poorly known than the adults. Of the North American species, only the larvae and purparia of *N. loewi, N. aenigma, N. carinata,* and *N. solita* have been figured (Berg, 1950; Deonier, et al, 1978 [1979]; Busacca and Foote, 1978). Studies on the immature stages of extralimital species are as follows:

1. *Notiphila brunnipes* Robineau-Desvoidy (palearctic): Torelli (1922); de Meijere (1940, 1941); Rousseau (1919); Hennig (1943).
2. *Notiphila nigricornis* Stenhammar (palearctic): Grünberg (1910).
3. *Notiphila phaea* Hendel (oriental): Hennig (1943).
4. *Notiphila riparia* Meigen (palearctic): Müller (1922); Varley (1937); Houlihan (1969).

Earlier studies on *Notiphila flaveola* (Goureau, 1851; Heeger, 1852) are apparently erroneous, being based on misidentified specimens of *Hydrellia* and *Scaptomyzetta* respectively. Hennig (1952) and Wirth and Stone (1956) provided partial, generic keys to the larvae of many shore flies including *Notiphila*.

The studies of Müller (1922), Varley (1937), and Houlihan (1969) report that larvae and puparia of *N. riparia* can be found attached to the roots of *Glyceria maxima* (Hartman) Holmberg, *Typha latifolia* L., and *Juncus effusus* (L.), with larger numbers on *Juncus* and *Glyceria*. Adults lay eggs on the aerial leaves and immediately after eclosion, the newly-hatched larva crawls down onto the roots. Houlihan's excellent study of the spiracular and root-piercing systems suggested that the thickness of the root epidermis is the limiting factor to respiration and is why fewer larvae and puparia of *N. riparia* were found on roots of *Typha*, which have a thicker epidermis than those of *Glyceria* or *Juncus*.

Details on the life history, ecology, etc. of the few Nearctic species that have been studied are included in the remarks section of the appropriate species.

Feeding in nature apparently spans a wide variety of foods. Deonier (1972) made gut dissections of several adult shore flies to determine the feeding habits. Included were three species of *Notiphila, N. macrochaeta, N. olivacea,* and *N. solita*. His results showed that the guts of all three species contained mostly algae other than diatoms, although some diatoms were present in all examinations. Busacca and Foote (1978) observed adults applying their mouthparts to the surfaces of emergent vegetation and suggested that they graze on the abundant microflora occurring on leaf surfaces. Dahl (1959) noted that *Notiphila* adults preferred dead or

slightly decomposed animal substance. I found that laboratory-caged adults readily fed on a mixture of honey and brewer's yeast.

Busacca and Foote (1978) examined the gut contents of third-instar larvae of *N. aenigma* and *N. solita* and found that bacteria and large amounts of detritus had been ingested. In the laboratory, they found that older larvae consumed cultured bacteria, but they were unable to rear larvae to adults on this diet. No algae were discovered in the guts of field-collected larvae.

Tribe NOTIPHILINI Cresson

DIAGNOSIS (modified from Cogan, 1968:286).—Small to large shore flies, length from less than 2.0 mm to over 1 cm; compound eye bare; lunule not developed above region of antennal insertion; ocellar bristles larger than postocellars, both may be reduced or absent in *Dryxo;* paravertical bristles usually strong, conspicuous, although secondarily reduced in some groups; posterior notopleural bristle, when present, inserted at ventral margin and weaker than anterior notopleural bristle; humeral and supra-alar bristles present; middle tibia with one to four distinct, usually dorsal-erect bristles toward base and frequently extending to apex; and abdominal terga usually fasciated along base although frequently interrupted medially.

Key to Genera of Notiphilini

1. Costa extending to vein R_{4+5}; 2 dorsocentral bristles (1+1) ..... **Notophila** Fallén, 1810
   Costa extending to vein M_{1+2}; either with 3 dorsocentral bristles (1+2), or dorsocentrals reduced or lacking 2
2. Two notopleural bristles; presutural dorsocentral bristle present; mid and hind femora developed normally 3
   One notopleural bristle; presutural dorsocentral bristle absent; mid and hind femora long and slender 4
3. Mesonotal setae other than along major setal tracts reduced or absent; aristal branches numbering three to four; sternopleural bristle usually lacking ..... **Oedenops** Becker, 1903
   Mesonotum more or less uniformly setose in addition to setae or bristles along major tracts; aristal branches usually numbering five or more; sternopleural bristle present ..... **Paralimna** Loew, 1862
4. Ocellar bristles present, sometimes weak; reclinate fronto-orbital bristle absent; series of long, weak setae along vein R_1 before humeral cross vein present; five to six larger setae posterodorsal of sternopleural bristle present; two larger, subequal, mesopleural bristles ..... **Dryxo** Robineau-Desvoidy, 1830
   Ocellar bristles absent; reclinate fronto-orbital bristle present; lacking a series of long, weak seta along vein R_1 before humeral crossvein; lacking five to six larger setae posterodorsad of sternopleural bristle; one larger, mesopleural bristle ..... **Karema** Cresson, 1929

Genus *Notiphila* Fallén

Notiphila Fallén, 1810:22 [type-species: *Notiphila cinerea* Fallén, by subsequent designation, Westwood, 1840:153].—Cresson, 1917:27–66 [key to Western Hemisphere species]; 1946:231–239 [revised key to North American species].—Wirth, 1965:746–748 [catalog of North American species].

Keratocera Robineau-Desvoidy, 1830:788. [A type-species has not been designated; synonymy according to Westwood, 1840:153.]

Pegophila Rondani, 1856:129. [Type-species: *Notiphila meridionalis* Rondani, by original designation; synonymy according to Becker, 1926:11.]

DIAGNOSIS.—Members of *Notiphila* closely resemble those of the genus *Paralimna,* and both share many similarities. Specimens of *Notiphila* are distinguished from those of *Paralimna* and other related genera in Notiphilini as follows: Costal vein short, extending to apex of vein R_{4+5}; base of costal vein between humeral and subcostal breaks lacking prominent setae except at apices; 2 pair of dorsocentral bristles (1+1); 1 pair of presutural bristles; 2 pair of notopleural bristles, both aligned near ventral notopleural margin; dorsal surface of middle tibia with 3 to 4 prominent, dorsoerect bristles, if only 3 are present, the apical one missing (1.1.1.0.); gena short; general coloration subdued, gray, pollinose, usually with considerable darkened areas, especially on abdomen; if specimens mostly dark brown, then fifth abdominal tergum of male pro-

duced apically into a slightly upturned, variously developed process with 2 to 3 terminal, stout bristles.

DESCRIPTION.—Moderately small to large shore flies, length 2.50 to 5.60 mm, females larger than males by an average of 0.12 mm; general coloration usually dull, subdued, pollinose, light brown to dark brown but usually with darker colored markings, especially on abdomen, members of the *caudata* group mostly dark brown.

Head: Head ratio 0.68–0.82; postfrons ratio 0.49–0.90; frons uniformly colored to distinctly marked with light and dark areas, some species with well-defined, blackish vittae laterally; ocelli arranged in isosceles or equilateral triangle, if isosceles, distance between posterior ocelli slightly longer than between either posterior ocellus and median ocellus; area surrounding ocellar triangle usually lighter in color, often concolorous with lateral margins of frons, narrowing anteriorly and often extending to anterior edge of frons; anterolateral edge of frons often slightly cinereous or at least lighter in color than remainder of lateral margin; chaetotaxy of frons as follows: Ocellar bristles well developed, 1 pair, proclinate; 1 or 2 pair of proclinate, fronto-orbital setae on lower fronto-orbital plate, sometimes lacking, if present situated laterad of larger, reclinate bristle, if 2 bristles present, anterior one more strongly developed; 1 pair of reclinate fronto-orbital bristles, strongly developed, subequal to outer vertical bristle, inserted near anterior margin of upper fronto-orbital plate; 1 pair each of inner and outer vertical bristles; 2 to 4 pair of smaller, divergent postocellar setae; usually 1 pair of prominent, paravertical bristles. Antenna variously colored, black to yellowish orange; second segment with 2 larger setae along anterior surface, apical one stouter, also with several smaller bristles extending anteriorly from ventral and medial surfaces; third antennal segment tomentose to pubescent; arista with pectinate branching along dorsal margin, number of branches varying from 6 to 15. Face generally lighter in color than frons, grayish yellow to light brown, pollinose, but varying considerably from niveous to brown; prefrons ratio 0.54–1.0; facial setae variously developed, small, hairlike to well-developed bristles, numbering 3 to 10. Eye ratio 0.69–0.35, higher than wide; eye-to-cheek ratio 0.12–0.35. Gena usually concolorous with face anteriorly, becoming grayer posteriorly;1 distinct genal bristle, much larger than surrounding setae, subequal to paravertical bristle; genal and occipital areas clothed with small setae, often in seriated rows; a distinct row of slightly larger postocular setae just posterior of compound eye, terminating dorsally in 1 to 2 larger setae. Maxillary palpus prominent, dark brown or black to yellowish orange; anteclypeal and prementum sclerites of mouthparts grayish black, pollinose; mouthparts usually withdrawn into oral cavity in preserved specimens.

Thorax: Members of the *caudata* group mostly unicolorous, dark brown; members of other species-groups as follows: Mesonotum usually darker in coloration than pleural area, especially the ventral pleural region, usually grayer anteriorly and often with some greenish to bluish coloration, becoming darker gray to light brown posteriorly; variously marked, immaculate to distinctly vittate, sometimes with dark maculation spots surrounding setal bases. Scutellum narrowly trapezoidal in shape, posterior edge truncate, concolorous with posterior half of mesonotum or slightly darker, lateral margin sometimes dark brown to black when viewed obliquely from posterior angle. Scutellum and mesonotum evenly covered with small setae. Pleural areas tending to become lighter, gray ventrally; mesopleuron, ventral portion of propleuron, and area surrounding large sternopleural bristle haired, other pleural areas bare. Chaetotaxy of thorax as follows: 2 pair of dorsocentral bristles (1+1); 1 pair of prescutellar acrostichal bristles situated between alignment of dorsocentral and acrostichal setae, widely separated; 1 pair of presutural bristles; 1 pair of interalar bristles, transversely aligned with prescutellar acrostichal bristles; 1 pair of supra-alar bristles; 1 pair of postalar bristles; 2 pair of lateral scutellar bristles, posterior pair inserted apically; 1 pair of humeral bristles, 2 pair of notopleural bristles, one inserted near each ventral corner, anterior bristles larger; 2 pair of mesopleural bristles near posterior margin, dorsal bristle about half the length of posterior bristle; 1 pair of sternopleural bristles. Wing ratio 0.36 to 0.47; costal vein ratio 0.32 to 0.60; M_{1+2} vein ratio 0.57–1.20. Femora generally dark, with considerable gray, pollinose areas; tibiae and tarsi various, often lighter colored at apices; mid tibia with 3 to 4 prominent, dorsal-erect bristles arranged 1.1.1.0. if 3 are present or 1.1.1.1. if 4 are present; often the posteroventral surface of the middle tibia

of males bears a row of closely set setae; anterior surface of middle femur with 2–3 larger preapical setae. Setal fascicle of hind basitarsus pale or dark. Halteres pale, cream white to slightly yellowed.

Abdomen: Five abdominal segments normally exposed in both sexes. Abdominal ratio in males 0.50–0.85; length of fourth tergum to fifth tergum ratio in males 0.63–1.90; fifth tergum ratio in males 0.39–0.84. Length of female abdomen longer by an average of 0.12 mm. Abdominal background coloration generally concolorous with thorax but usually with darker markings, markings various, fasciated, to guttate or nearly immaculate. Terga setulose, setae along posterior margin of each tergum longer. Female terminalia consisting of abdominal segments 6, 7, and 8 plus cerci and possibly the ninth sternum; often segment 7 very poorly sclerotized or not at all evident. First abdominal spiracle lies in membrane near venter of first tergum, spiracles 2–6 in ventral portion of respective terga 1 ventral receptacle present, variously helmet-shaped but with extending process. Male terminalia symmetrical, reduced to fused ninth and tenth terga (epandrium), surstyli, ninth sternum (hypandrium), hypandrial process (gonite), aedeagal apodeme and aedeagus, the latter composed of a sclerotized basiphallus and membranous distiphallus; see subgeneric descriptions for further details on male terminalia.

Discussion.—*Notiphila* is a worldwide genus of approximately 135 species and about twice as many available names. Nearly half of the known species are from the Western Hemisphere and two-thirds of these are nearctic. Most faunas are very incompletely known; no species are known to occur in the Antarctic or Arctic.

Key to Subgenera of *Notiphila* Fallén

Middle tibia with 3–4 erect bristles along dorsum; if 4, body generally light colored, gray to light brown; if 3, body mostly dark brown; 2 pair of small, proclinate, fronto-orbital setae inserted laterad of larger, reclinate, fronto-orbital bristle; front coxa with 2, distinctly-larger setae on lower half of anterolateral margin; middle femur of male without posteroventral comb of setae ..... Subgenus **Dichaeta** Meigen

Middle tibia with 3 erect bristles along dorsum; 1 or no pairs of small, proclinate, fronto-orbital setae lateral of larger, reclinate, fronto-orbital bristle; front coxa lacking distinctly-larger setae on lower half of anterolateral margin; middle femur of males with comblike row of setae along posteroventral margin ..... Subgenus **Notiphila** Fallén

Subgenus *Notiphila* Fallén

Notiphila (Notiphila) Fallén.—Cresson, 1917:31. [See generic synonymy.]

Diagnosis.—Members of the nominate subgenus *Notiphila* are distinguished from those of *Dichaeta* by the following combination of characters: 3 or fewer dorsal extensor bristles along middle tibia; middle femur and middle tibia often with a comblike row of setae along the posteroventral margins in males; generally fewer facial setae, 3–4, these often more strongly developed, bristlelike; antenna, or at least 1 segment, frequently partially or entirely pale, usually yellowish orange; maxillary palpus also pale; at most with 1 pair of proclinate, fronto-orbital setae laterad of larger reclinate bristle; and abdominal markings, although sometimes fasciated, often guttate, barely evident, or absent. Male terminalia differing as follows: Ventral margin of epandrium usually produced into symmetrical process of various shapes; surstyli reduced; hypandrial process smaller but densely setulose or bearing 2–3 apical setae; with small, linear process extending on each side from surstylus to the base of the basiphallus, which is absent in specimens of *Dichaeta*; hypandrial receptacle divided into 2 thin strips, these frequently poorly sclerotized. Sclerotization of female terminalia variable but often sixth and seventh segments well sclerotized; operculum of female ventral receptacle not higher than wide and extending process bearing lateral processes, usually helically curved, but rather straight in some. Larvae and pupae with short respiratory tube, tube much less than half total body length.

Description.—Moderately small to large shore flies, length 2.45 to 5.60 mm; generally background coloration light gray to brown with some darker brown markings.

Head: Head ratio 0.70–0.82 (mean of 0.75); postfrons ratio 0.60–0.90 (mean of 0.70); frons unicolorous or with lighter colored, narrow, median triangular area; at most with 1 pair of small, proclinate, fronto-orbital setae laterad of larger reclinate bristle; dorsalmost postocular bristles variable in length. One or more antennal segments partially or entirely pale, darkened portions dark brown, seldom black. Face niveous to light yellow, pollinose; facial setae often large, bristle-like, usually numbering 3–4 and limited to ventral half of face; prefrons ratio 0.61–1.0 (mean of 0.79). Eye ratio 0.73–0.90 (mean of 0.77); eye-to-cheek ratio 0.14–0.35 (mean of 0.22). Maxillary palpus pale, yellow to orange.

Thorax: Mesonotum usually darker than pleural areas, generally immaculate but often with distinct, brown vittae. Lateral margin of scutellum in some specimens dark brown to black when viewed from posteroblique angle. Femora usually dark; tibiae and tarsi generally pale; if tibiae are dark, their apices pale; middle tibia with 3 dorsal-erect bristles or larger bristles reduced or absent; middle femur of male usually with dense comblike row of setae along posteroventral margin; middle tibia also with distinct, ventral row of shorter setae. Setal fascicle of hind basitarsus pale or dark; if dark, then 2–4 setae are dark. Wing ratio 0.37–0.46 (mean of 0.42); costal vein ratio 0.36–0.60 (mean of 0.48); M_{1+2} vein ratio 0.80–1.20 (mean of 0.98).

Abdomen: Abdomen ratio of males 0.50–0.85 (mean of 0.74); length of fourth tergum/fifth tergum of males 0.64–1.90 (mean of 1.07); fifth tergum ratio of males 0.39–0.84 (mean of 0.53). Darker markings usually guttate, infrequently fasciated, with two geminate spots or immaculate. Fifth tergum never produced into extending, narrow process with elaborate setation as in specimens of subgenus *Dichaeta*. Male terminalia as in diagnosis as follows: Surstyli reduced, triangular in shape; a secondary process extending from surstyli to base of basiphallus; hypandrial process smaller, lobelike, although in specimens of some species much longer than wide, with 2–3 apical setae or clothed with small spinules; sclerotized basiphallus often broadened apically; membranous distiphallus with or without armed spinules. Female terminalia as in diagnosis.

Discussion.—The subgenus *Notiphila* is represented at present by 25 known nearctic species. Most are found east of the Mississippi River and, based on actual numbers of specimens collected, they are not as abundant as *Dichaeta* specimens in the West. The subgenus seems to predominate in the rest of the world, especially in the Palearctic Region.

Key to North American Species of the Subgenus *Notiphila*

1. Lateral margin of scutellum dark, usually blackish when viewed from posteroblique angle 2
   Lateral margin of scutellum generally concolorous with dorsum or slightly darkened, not blackish when viewed from posteroblique angle 7
2(1). Setal fascicle of hind basitarsus with at least 1 darkened seta; postfrons ratio usually less than 1:0.85 3
   Setal fascicle of hind basitarsus entirely pale; postfrons ratio usually greater than 1:0.85 5
3(2). Dorsum of mesonotum immaculate except for small, darkened spot just anterior of presutural bristle; facial series of setae strong, subequal to largest genal bristle; fascial coloration generally gray and often with brown median stripe on lower two-thirds ..... 12. **N. pulchra**, new species
   Dorsum of mesonotum vittate; facial series of setae less strongly developed, hairlike; facial coloration grayish yellow to light gray and without median stripe 4
4(3). Fifth abdominal segment of male nearly as long as wide, distinctly turned down apically; median stripe of mesonotum narrower and shorter than lateral stripes ..... 25. **N. solita** Walker
   Fifth abdominal segment of male almost twice as wide as long, not distinctly turned down apically; mesonotum with median stripe subequal to lateral stripe ..... 22. **N. pauroura**, new species
5(2). Fifth abdominal segment ratio in males 1:0.75 or greater and noticeably turned down apically; third antennal segment mostly pale ..... 6. **N. nudipes** Cresson

Fifth abdominal segment ratio in males 1:0.50 or less and not noticeably turned down apically; third antennal segment mostly dark 6

6(5). Eye-to-cheek ratio 1:0.25 or greater; third antennal segment almost entirely dark; basiphallus enlarged apically ....2. **N. bella** Loew

Eye-to-cheek ratio 1:0.20 or less; third antennal segment usually pale toward postero-ventral angle; basiphallus lacking apical enlargement ....8. **N. taenia**, new species

7(1). General background coloration dark brown; face and frons concolorous, dark grayish brown; mesonotum and mesopleuron immaculate ....11. **N. phaeopsis**, new species

General background coloration lighter, gray to light brown; face and frons not concolorous, dark grayish brown; mesonotum or mesopleuron often with some maculation pattern 8

8(7). With the following combination of characters: eye ratio 1:0.85 or greater; eye-to-cheek ratio 1:0.30 or greater; dorsum of abdomen mostly gray; tibiae and tarsi pale 9

Combination of characters not as above 10

9(8). Setal fascicle entirely pale; mesopleuron immaculate ....4, **N. cognata** Cresson

Setal fascicle dark, black; mesopleuron often with maculation area on dorsal half which contrasts with grayer ventral half ....17. **N. floridensis** Cresson

10(8). Prefrons ratio 1:0.88 or greater; facial setae bristlelike, subequal to genal bristle 11

Prefrons ratio 1:0.84 or less; facial setae hairlike, much smaller than genal bristle 13

11(10). Length 4.0 to 5.2 mm; tibiae mostly dark 12

Length 3.0 to 4.25 mm; tibiae pale ....10. **N. erythrocera** Loew

12(11). Third antennal segment often with some pallor; male genitalia as in Figures 37–38; widely distributed ....9. **N. avia** Loew

Third antennal segment almost entirely dark; male genitalia as in Figures 52–54; Quebec ....13. **N. robusta**, new species

13(10). Lobe of hypandrial process enlarged, clothed with spinules 14

Lobe of hypandrial process not enlarged or clothed with spinules but often with 2–3 apical setae 17

14(13). Antennal segments entirely pale; male genitalia as in Figures 32–33 ....7. **N. pallicornis**, new species

First and second antennal segments usually dark; male genitalia not as above 15

15(14). Eye-to-check ratio 1:0.25 or greater; male genitalia as in Figures 24–26 ....5. **N. footei**, new species

Eye-to-cheek ratio 1:0.20 or less; male genitalia not as above 16

16(15). Mesopleuron often with dark brown maculation spot; gena very narrow; male genitalia as in Figures 9–11 ....1. **N. adusta**, new species

17(13). Body coloration mostly gray; frons lacteous; third antennal segment mostly pale ....23. **N. poliosoma**, new species

Body coloration mostly light brown, not extensively gray; frons at most brownish gray; third antennal segment usually mostly dark 18

18(17). Eye-to-cheek ratio 1:0.24 or greater 19

Eye-to-cheek ratio 1:0.21 or less 21

19(18). Ventral process of epandrium with divergent arms; eye-to-cheek ratio 1:0.30 ....18. **N. latigena**, new species

Ventral process of epandrium with parallel arms; eye-to-cheek ratio less than 1:0.30 20

20(19). Arms of epandrial process with preapical enlargements; pocket formed by arms notched basally; ventral margin of basiphallus with abrupt median bulge ....24. **N. shewelli**, new species

Arms of epandrial process evenly tapering to point; pocket formed by arms without basal notch; ventral margin of basiphallus sinuate, not with abrupt bulge ....21. **N. unicolor** Loew

21(18). Basiphallus much longer than wide, without distinct apical enlargement 22

Basiphallus about as wide as long, apically enlarged 23

22(21). Small flies, length 2.40 to 3.20 mm; eye-to-cheek ratio 1:0.18 or less; pocket formed by arms of ventral epandrial process more or less diamond-shaped ....15. **N. cressoni**, new name

Medium-sized flies, length 3.0 to 0.4 mm; eye-to-cheek ratio 1:0.20 or more; pocket formed by arms of ventral epandrial process V-shaped ....19. **N. loewi** Cresson

23(21). Arms of ventral epandrial process divergent, sinuate, but tapering evenly to tip ..... 20. **N. oriens,** new species
Arms of ventral epandrial process, projecting straight, not tapering evenly 24
24(23). Pocket formed by arms of ventral epandrial process broadly U-shaped ..... 14. **N. carinata** Loew
Pocket formed by arms of ventral epandrial process as in Figures 66–68 ..... 16. **N. eleomyia,** new species

The *adusta* Group

SPECIES INCLUDED.—*Notiphila adusta,* new species; *N. bella* Loew; *N. biseriata* Cresson; *N. cognata* Cresson; *N. footei,* new species; *N. nudipes* Cresson; *N. pallicornis,* new species; *N. taenia,* new species.

DIAGNOSIS.—The hypandrial process of the male terminalia is enlarged, usually considerably longer than wide, and the apical half is covered with short, stout spinules (see species figures for examples).

GEOGRAPHIC DISTRIBUTION.—With the exception of *N. pallicornis,* all species of this group occur in the vicinity of, or directly east and west of, the Great Lakes. This pattern coincides with the southernmost extension of the ice covering during the Wisconsin glaciation period.

DISCUSSION.—This is the most homogeneous species-group of this subgenus, and the included species may be easily recognized by the character states listed in the diagnosis. Eight nearctic species belong to the group and, as a whole, it is somewhat intermediate with respect to the other two species-groups of this subgenus. Many of the species included here share characteristics with species belonging to the other groups.

1. *Notiphila (Notiphila) adusta,* new species

FIGURES 9–12

DIAGNOSIS.—Specimens of this species closely resemble those of *N. footei* but may be distinguished from the latter by the following combination of characters: Gena very narrow, making eye-to-cheek ratio significantly less than that for specimens of *N. footei*; mesopleuron bearing a dark brown maculation area that contrasts distinctly with the lighter background color; male genitalia diagnostic, similar to those of *N. footei* males, especially in the joint possession of a well-developed, spine-covered lobe of the hypandrial process, but differing consistently in shape of ventral processes of epandrium; both arms of ventral process of *N. adusta* males more slender in relation to size of epandrium, they are also longer. See Figures 9–11.

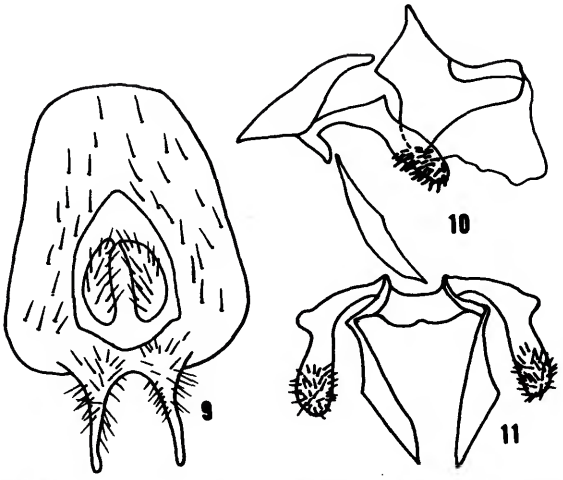
DESCRIPTION.—Moderately small to moderately large shore flies, length 2.90 to 4.25 mm; with light brown, dusted background color and few darker brown markings.

Head: Head ratio 1:0.71; postfrons ratio 1:0.67; median triangular area and lateral margins of frons concolorous, lighter in color and grayer than remainder of frons which has some charcoal or dark green reflections. Paravertical bristles medium sized, not much larger than postocellar setae; at most with one pair of proclinate, fronto-orbital setae. First and second antennal segments dark brown to black; third segment mostly pale, yellowish orange but with anterodorsal margin darkened; arista with approximately 10 dorsal branches. Face yellow, lightly pollinose; prefrons ratio 1:0.69; facial setae small, hairlike, numbering 3–4. Eye ratio 1:0.82; eye-to-cheek ratio 1:0.165. Gena very narrow, generally concolorous with face but becoming grayer posteriorly. Genal bristle subequal to paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Generally unicolorous, light brown, pollinose, although pleural areas slightly lighter in color posteriorly. Mesonotum immaculate; mesopleuron with a dark brown maculation area. Femora mostly dark with gray dusted areas, apically pale; tibiae generally concolorous with femora but with more extensive, pale areas on apices; front tarsomeres usually darkened superficially, middle and hind tarsomeres pale, mostly yellowish orange. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.45; costal vein ratio 1:0.47; M_{1+2} vein ratio 1:0.82.

Abdomen: Abdomen ratio of males 1:0.75; length of fourth tergum to fifth tergum ratio of males 1:1.3; fifth tergum ratio of males 1:0.58. Abdominal maculation pattern as in most specimens of the *loewi* group. Male terminalia as in diagnosis and in Figures 9–11.

TYPE-MATERIAL.—Holotype male: "Hull, Que-



FIGURES 9–11.—*N. adusta*: 9, epandrium, cerci, and ventral epandrial processes, posterior aspect; 10, internal male genitalia, lateral aspect; 11, hypandrial processes, hypandrial receptacles, ventral aspect.

bec, 20 June 1956, J. R. Vockeroth/HOLOTYPE Notiphila adusta Mathis (red)." Allotype and three paratypes (all ♀) with the same label data as the type. Other paratypes as follows: 2♂, 3♀, Canada, Ottawa, Mer Bleue, 2 July 1938, A. L. Melander (ANSP, USNM). The holotype will be deposited in the Canadian National Collection, Ottawa, type number 15688.

OTHER SPECIMENS EXAMINED (61).—CANADA: ONTARIO: Marmora (CNC); Mer Bleue (CNC); One Sided Lake (CNC); Ottawa (CNC); Simcoe (CNC); Toronto (ANSP). QUEBEC: Hull (CNC); Kazabazua (CNC). UNITED STATES: ILLINOIS: Lake Co., Waukegan (ANSP, INHS). IOWA: Hamilton Co., Little Wall Lake (ISU). MICHIGAN: Iron Co., (USNM); Keweenaw Co., (USNM); Monroe Co., Monroe (USNM); Wayne Co., Grosse Ile (USNM); Wexford Co., Woodward Lake (MSU). MINNESOTA: Chisago Co. (UMN); Clearwater Co., (UMN), Itasca State Park (UMN); Houston Co., (UMN); Lake Co., Basswood Lake (UMN); Wabasha Co., Wabasha (UMN). NEW YORK: Chautaugua Co., Ivory (USMN); Genesee Co., Bergen (USNM); Tompkins Co., Enfield (USNM), White Church (CU); Schuyler Co., Texas Hollow (CU). NORTH DAKOTA: Trail Co., (ANSP). SOUTH DAKOTA: Minnehaha Co., Dell Rapids (ANSP). WISCONSIN: Sauk Co., Devils Lake (ANSP).

ETYMOLOGY.—The Latin adjective *adusta* ("tanned" or "brown") refers to the body color.

GEOGRAPHIC DISTRIBUTION (Figure 12).—The known distribution of *N. adusta* is limited to the states or provinces surrounding the Great Lakes with the exception of one locality in Iowa. Collection dates are from 21 May to 27 October.

REMARKS.—The habitat of this species is apparently limited to lentic water systems. The specimen from Iowa bore a label reading "on limnic wrack," which is a habitat type used by Deonier (1965) in his paper on the ecology of the shore flies of Iowa. Nothing more is known regarding the biology of this species.

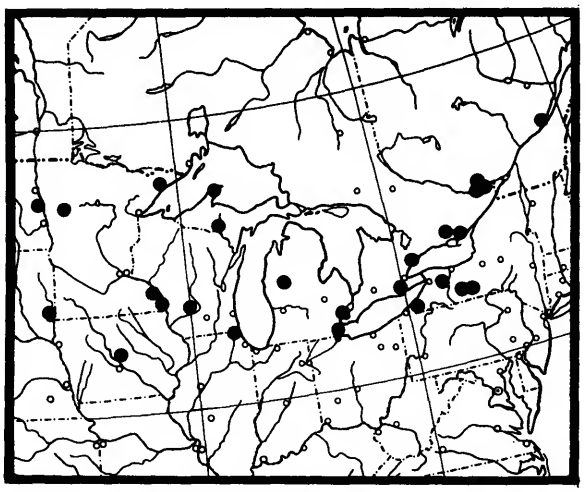


FIGURE 12.—*N. adusta*: distribution map.

2. *Notiphila (Notiphila) bella* Loew

FIGURES 13–15

Notiphila bella Loew, 1862:135.
Notiphila (Notiphila) nudipes Cresson [in part], 1917:43.
Notiphila (Notiphila) bella Cresson, 1946:234.

TYPE-MATERIAL.—Lectotype male (herein designated): "Mittel St. (green)/Loew Coll./bella ♂/ Type 11134/Notiphila bella Lw, det W. Wirth '61/LECTOTYPE Notiphila bella Loew by W. N. Mathis (red)." The lectotype is in the Museum of Comparative Zoology, Harvard University, type number 11134. Loew's original description indicated that both male(s) and female(s) were in the type series, and on a visit to the M.C.Z. I did locate a male and female specimen of *N. bella* with Loew's locality data. Both specimens also bear the paratype labels "M.C.Z. Paratype 11134," and are herein designated as paralectotypes.

DIAGNOSIS.—Although specimens of *N. bella* very closely resemble those of other species belonging to the *adusta* group, they may be distinguished from them as follows: Antenna mostly black but extreme base of third segment may be pale, yellowish; fifth abdominal tergum considerably wider than long; genitalia of *N. bella* males most similar to those of *N. taenia,* but differing in the shape of the basiphallus, hypandrial process, and ventral process of epandrium. These differences are readily seen in Figures 13–15.

DESCRIPTION.—Medium-sized shore flies, length 3.03 to 3.64 mm, with bluish gray to brownish gray background coloration and few brown markings.

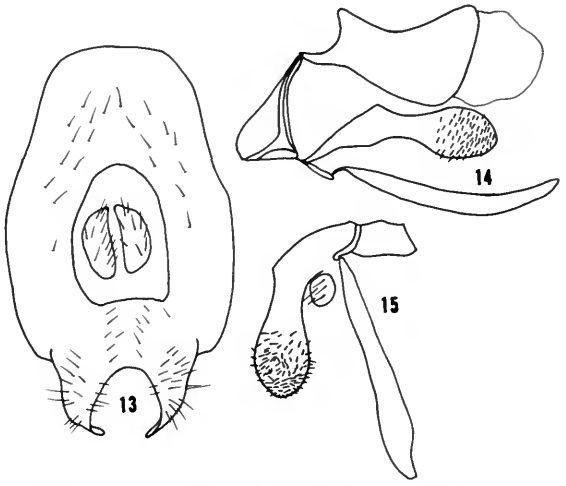
Head: Head ratio 1:0.78; postfrons ratio 1:0.89; frons subdued in coloration, mostly gray, median triangular area and lateral margins generally concolorous, remaining area of frons darker, slightly charcoal colored. Paravertical bristles small, approximately half the length of the genal bristle. No proclinate, fronto-orbital setae evident. Antennal segments mostly dark, black, although the base of the third segment slightly paler, orange; arista with 7–8 dorsal branches. Face very lightly colored, almost cinereous and nearly concolorous with frons; prefrons ratio 1:0.72; facial setae small, hairlike, only on ventral half of face. Eye ratio 1:0.81, eye-to-cheek ratio 1:0.26. Gena unicolorous, slightly darker in shade than face; genal bristle located posteriorly, size approximately double that of paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Mesonotum brownish gray, darker than pleural areas; lateral margin with a brown stripe extending from anterior to presutural bristle to supra-alar bristle. Lateral margin of scutellum dark, blackish brown when viewed from posteroblique angle. Mesonotum with prominent brown stripe along dorsal margin. Femora gray, pale apically; tibiae and tarsi pale, yellow. Setal fascicle of hind basitarsus pale, yellow. Wing ratio 1:0.39; costal vein ratio 1:0.46; M_{1+2} vein ratio 1:0.96.

Abdomen: Abdomen ratio of males 1:77; length of fourth tergum to fifth tergum ratio of male 1:1; fifth tergum ratio of male 1:0.46. Fascia of the terga usually well defined, trigonal, sometimes reduced to a few spots. Male terminalia as in diagnosis and Figures 13–15.

SPECIMENS EXAMINED.—One specimen with the following label data: Osten Sacken Coll. (ANSP).

GEOGRAPHIC DISTRIBUTION.—Middle states.



FIGURES 13–15.—*N. bella:* 13, epandrium, cerci, and ventral epandrial processes, posterior aspect; 14, internal male genitalia, lateral aspect; 15, hypandrial process, hypandrial receptacle, ventral aspect of one side.

REMARKS.—*Notiphila bella* is known only from the type-series and the single male specimen from Osten Sacken's collection. The distinctions between specimens of this species and those of *N. taenia* are subtle and will probably require dissection of the male genitalia for accurate identification. Because the genitalic structures are consistently different, however, *N. taenia* is recognized as distinct from this species.

3. *Notiphila (Notiphila) biseriata* Cresson

FIGURES 16–19

Notiphila (Notiphila) biseriata Cresson, 1917:46.
Notiphila (Notiphila) loewi Cresson [in part], 1946:235.
Notiphila (Notiphila) loewi var. *biseriata.*—Wirth, 1965:747.

TYPE-MATERIAL.—Holotype male: "♂/Sandusky, O./HoloTYPE, Notiphila biseriata, E. T. Cresson Jr./Loan property of Ohio U." The holotype is in the Ohio State University insect collection, Columbus.

DIAGNOSIS.—Externally, specimens of *N. biseriata* appear to be similar to those of *N. loewi* and for many years species were considered to be conspecific. However, the terminalia of male specimens of *N. biseriata* differ considerably as shown by comparing Figures 17–19. Ventral process of epandrium

proportionately narrower and cleft formed by arms of process deeply U-shaped; ventral margin of the basiphallus but slightly sinuate and posterior portion of aedeagal apodeme not produced into a lobe; hypandrial process as long as wide and lobe greatly enlarged and clothed with short, stout setae; maculation pattern of dorsum of abdomen more pronounced and geminate markings broader than those of specimen of *N. loewi*; eye-to-cheek ratio of most specimens of *N. loewi* less than in those of *N. biseriata*.

DESCRIPTION.—Moderately large shore flies, length 4.04 mm; with subdued tan to gray coloration.

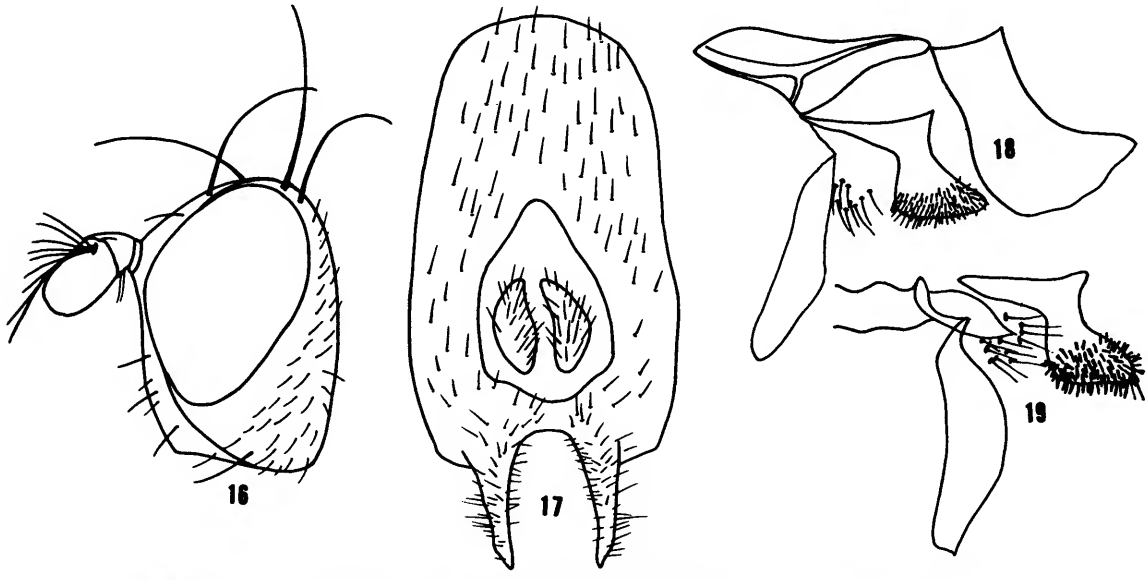
Head (Figure 16): Head ratio 1:0.77, mesofrons darker than lateral margins of postfrons, blackish gray; small brown triangle extending from anterior margin of postfrons; postfrons ratio 1:0.78. Paravertical bristle much larger than postocellar setae, subequal to ocellar bristles; proclinate, frontoorbital seta small, hairlike. First and second antennal segments dark, blackish; basal half of third antennal segment light orange, apical half dark; concolorous with first and second segments; dorsal aristal branches numbering 9–10. Prefrons yellowish gray, uniformly colored; prefrons ratio 1:0.80; facial setae with 3–4 primary setae, hairlike, approximately subequal to genal bristle. Eye slightly higher than wide, ratio 1:0.75; eye-to-cheek ratio 1:0.195, gena concolorous with face anteriorly, becoming more grayish posteriorly. Maxillary palpus pale, yellow.

Thorax: Dorsum of mesonotum brownish gray, with blue tinges toward anterior margin, some indications of a median stripe. Pleural areas more gray to bluish gray. Femora gray except for brown dorsum; front tibia and tarsi generally dark brown to black except for yellow apices, middle and hind tibiae yellow to black, tarsi lighter, usually yellow. Setal fascicle of hind basitarsus with 2–3 dark brown setae. Wing ratio 1:0.41; costal vein ratio 1:0.32; M_{1+2} vein ratio 1:0.68.

Abdomen: Length of fourth to fifth tergum ratio of males 1:1; fifth tergum ratio of males 1:0.39. Dorsum generally gray to bluish gray; segments 2–5 with geminate brown spots separated with gray median stripe. Male terminalia as in diagnosis and in Figures 17–19.

SPECIMENS EXAMINED.—This species is known only from the male holotype.

GEOGRAPHIC DISTRIBUTION.—The type-locality,



FIGURES 16–19.—*N. biseriata:* 16, head, lateral aspect; 17, epandrium, cerci, epandrial processes, posterior aspect; 18, internal male genitalia, lateral aspect; 19, hypandrial process, hypandrial receptacle, ventral aspect of one side.

Sandusky, Ohio, is the only site where this species has been collected.

REMARKS.—Until the present study, this species was considered to be conspecific with *N. loewi* and externally specimens of both species are very similar. However, the male genitalia of the type of *N. biseriata* are markedly dissimilar and because the type was collected sympatrically with *N. loewi, N. biseriata* is given species status here.

4. *Notiphila (Notiphila) cognata* Cresson

FIGURES 20–23

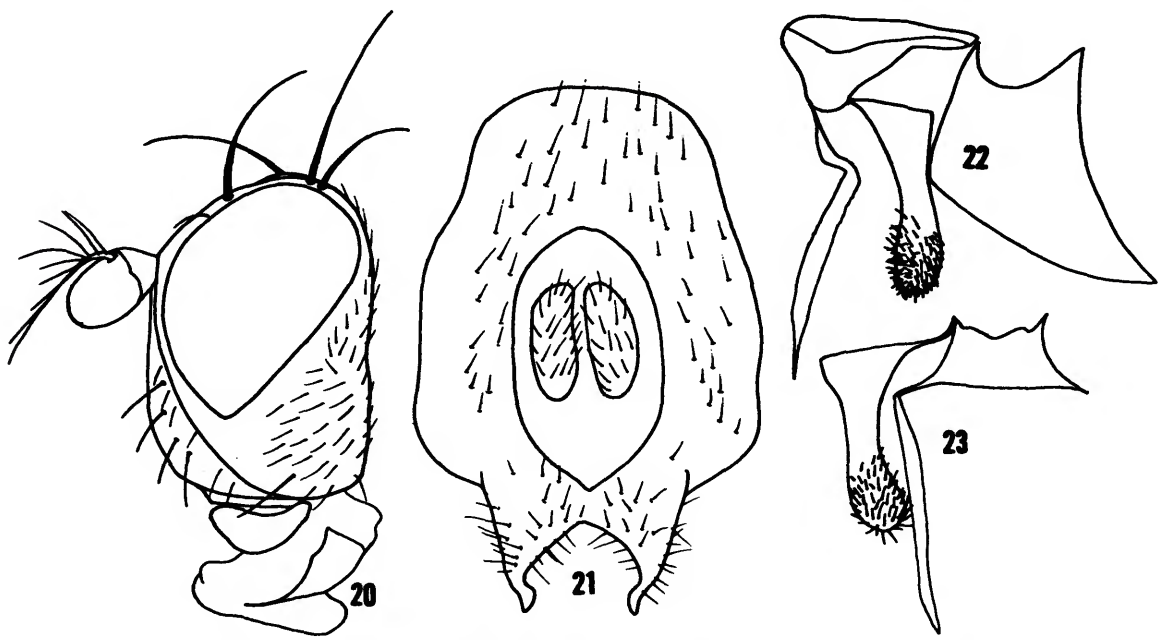
Notiphila (Notiphila) cognata Cresson, 1917:46.
Notiphila (Notiphila) floridensis Cresson [in part], 1946:235.

TYPE-MATERIAL.—Holotype male: "Manahawkin, V-30-10, N.J./Det. by Coq'll't./♂; holoTYPE 6111/Holo-TYPE Notiphila cognata, E. T. Cresson Jr." The holotype is deposited in the Academy of Natural Sciences of Philadelphia, type number 6111.

DIAGNOSIS.—Superficially, specimens of *N. cognata* very closely resemble those of *N. floridensis* but may be differentiated from the latter by the following combination of characters: Mesopleuron immaculate, without any trace of a darker brown area that contrasts with surrounding, lighter gray background color; dorsum of mesonotum generally unicolorous although with faint indication of a median stripe; setal fascicle of hind basitarsus entirely pale, light yellow. The characters of the male terminalia more clearly distinguish *N. cognata* specimens from those of *N. floridensis*. Ventral processes of epandrium of *N. cognata* males arising from much broader base and projecting outward with slightly convergent orientation; process distinctly tapering, especially along the median surface but partially expanded just before apex; dorsal margin of aedeagal apodeme slightly sinuate but not deeply concave and ventral surface of basiphallus more or less straight before angling upward; lobe of hypandrial process much longer than its base, slightly spatulate apically, and covered apically with stout bristles.

DESCRIPTION.—Medium-sized shore flies, length 3.54 mm; with subdued tan dorsum becoming gray ventrally.

Head (Figure 20): Head height-to-width ratio 1:0.77; postfrons generally gray unicolorous except for brownish-colored median triangle that extends



FIGURES 20–23.—*N. cognata:* 20, head, lateral aspect; 21, epandrium, cerci, and epandrial processes, posterior aspect; 22, internal male genitalia, lateral aspect; 23, hypandrial process, hypandrial receptacle, ventral aspect of one side.

anteriorly from ocellar bristles and for light colored area along margin of eye; postfrons ratio 1:0.65; postocellar and paravertical bristles reduced, hairlike; 1 very small proclinate, fronto-orbital seta. First and second antennal segments dark, third segment orange basally, becoming darkened apically; dorsal aristal branches numbering 6–7. Prefrons and gena generally concolorous, white, although posteriorly, gena becoming slightly bluish; prefrons ratio 1:0.78; facial setae hairlike, smaller than genal bristle, extending to approximately half height of prefrons. Eye almost as wide as long, ratio 1:0.9; gena wide, eye-to-cheek ratio 1:0.3. Maxillary palpus yellow.

Thorax: Dorsum of mesonotum tan, generally unicolorous; from posterior margin of notopleuron becoming gray to whitish gray. Femora gray; tibiae and tarsi pale, grayish yellow to yellow. Middle femur with comb of closely-set bristles along both anteroventral and posteroventral margins; middle tibia with row of small, closely-set bristles on ventral surface, becoming indistinct apically. Setal fascicle of hind basitarsus pale, yellow. Wing ratios as follows: length-to-width ratio 1:0.43; costal vein ratio 1:0.41; M_{1+2} vein ratio 1:0.91.

Abdomen: Generally bluish gray, without definite maculation pattern although second, third, and fourth terga with brown coloration, mostly along anterior margins. Fifth to fourth terga length ratio 1:0.95 in males; fifth terga ratio 1:0.46. Male terminalia as in diagnosis and Figures 21–23.

SPECIMENS EXAMINED.—*Notiphila cognata* is known only from the male holotype.

GEOGRAPHIC DISTRIBUTION.—The type-locality, Manahawkin, New Jersey, is the only site where this species has been collected.

REMARKS.—*Notiphila cognata* was listed as a junior synonym of *N. floridensis* in the recent catalog of North American Diptera (Wirth, 1965). However, the genitalia of the male holotype of *N. cognata* are very dissimilar from those of its congener and are the basis for considering it to be a valid species.

5. *Notiphila (Notiphila) footei*, new species

FIGURES 24–27

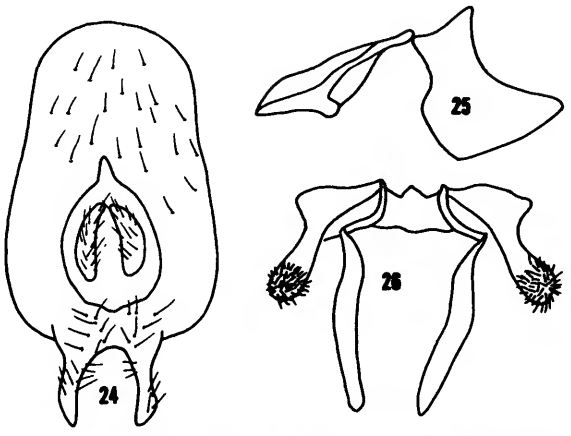
DIAGNOSIS.—Specimens of *N. footei* appear to be closely allied to those of *N. adusta*, as evidenced by their overall, external similarity, especially male genitalic structures. However, specimens of *N. footei* may be distinguished by the following combination of characters: Gena wide, resulting in reduced eye-to-cheek ratio; mesopleuron immaculate; arms of ventral epandrial process thick and proportionately shorter in relation to length of epandrium. These latter differences are best seen in Figures 24–26.

DESCRIPTION.—Medium-sized shore flies, length approximately 3.30 mm (the abdomens were removed before measuring); with light brown to brown background coloration and some darker markings.

Head: Head ratio 1:0.73; postfrons ratio 1:0.68; frons mostly brown, pollinose, with some charcoal or greenish coloration, median triangular area and margins usually lighter in color, concolorous. Paravertical bristle slightly larger than postocellar bristles; usually with 1 pair of proclinate, fronto-orbital setae. First and second antennal segments generally dark brown, third segment with pale, generally orange, posteroventral area, otherwise darkened; arista with 8–10 dorsal branches. Face unicolorous, yellow, lightly pollinose, gray; prefrons ratio 1:0.76; facial setae small, hairlike, numbering 3–4. Eye ratio 1:0.84; eye-to-cheek ratio 1:0.26. Gena moderately wide, generally concolorous with face, especially anteriorly, becoming grayer posteriorly, genal bristle subequal to paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Generally brown to tan, unicolorous although pleural areas tending to become lighter posteriorly. Mesonotum and mesopleuron usually immaculate, some specimens with faint indication of darker spot on mesopleuron. Femora dark, usually black with dusted gray areas, pale apically; tibiae mostly dark, especially front and middle tibiae, hind tibia with more extensive pale areas; front tarsomeres mostly dark brown to blackish brown but with some pale coloration, tarsomeres of middle and hind legs pale. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.41; costal vein ratio 1:0.37; M_{1+2} vein ratio 1:0.74.

Abdomen: Length of fourth tergum to fifth tergum ratio of males 1:0.96; fifth tergum ratio of males 1:0.55. Maculation pattern not usually contrasting distinctly with background color, both dark, as in most species of the *loewi* group. Structures of male as in diagnosis and in Figures 24–26.



FIGURES 24–26.—*N. footei:* 24, epandrium, cerci, and epandrial processes, posterior aspect; 25, intenal male genitalia, lateral aspect; 26, hypandrial process, hypandrial receptacle, ventral aspect.

TYPE-MATERIAL.—Holotype male: "Montana, Lake Co. 1 mi [1.6 km] S Swan Lake 9 August 1972 Wayne N. Mathis/HOLOTYPE Notiphila footei W N Mathis (red)." Other paratypes as follows: 1♂, Montana, Lake Co., 2.3 mi [3.7 km] E. Bigfork, 9 August 1972, Wayne N. Mathis (WNM); 1♂, 1 mi [1.6 km] W Big Fork, Montana, 19 July 1973, J. Busacca collector (KSU); 1♂, St. Paul, Minn., Bussey's Pond, 9 June 1921, W. E. Hoffman (UNM); 1♂, Missisquoi Bay, Quebec, 11 July 1927, G. S. Walley (CNC); 1♂, Arenac Co., Michigan, 18 June 1950, R. R. Dreisback (MSU). The holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73549.

ETYMOLOGY.—The genitive patronym *footei* honors Dr. Benjamin A. Foote in recognition of his many contributions to our knowledge of the shore flies.

GEOGRAPHIC DISTRIBUTION (Figure 27).—*Notiphila* footei occurs between 45° and 50° north latitude, from Flathead Lake, Montana in the west to Missisquoi Bay, Quebec in the east. Collection dates are from 9 June to 9 August.

REMARKS.—The type and paratypes that I collected were taken in grass- to sedge-meadow habitats around the margins of lentic aquatic systems in northwestern Montana.

6. *Notiphila (Notiphila) nudipes* Cresson

FIGURES 28–31

Notiphila (Notiphila) nudipes Cresson, 1917:43.

TYPE-MATERIAL.—Holotype male: "Woodbury 6–27–(18)'96, N(ew). J(ersey)./HoloTYPE 6110/ Notiphila vittata Lw (folded)/Holo-TYPE Notiphila nudipes E. R. Cresson Jr." The holotype is deposited in the Academy of Natural Sciences of Philadelphia, type number 6110. Cresson's original description also listed two male paratopotypes and cited C. W. Johnson as the collector of the type-series.

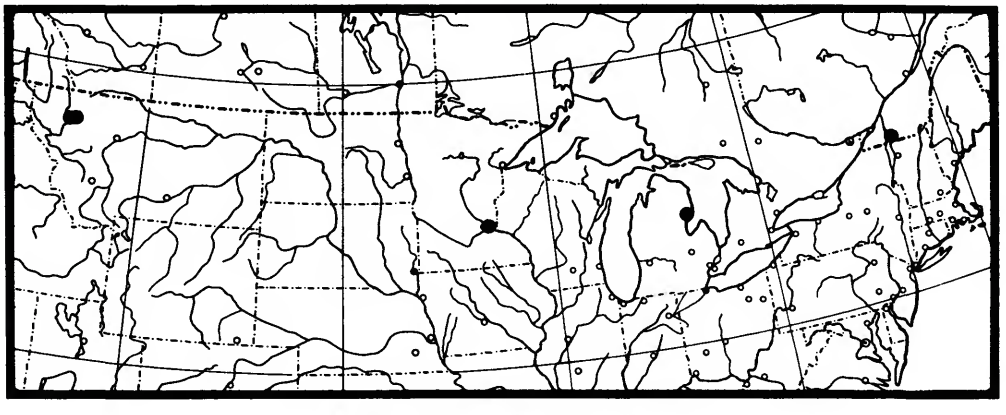


FIGURE 27.—*N. footei:* distribution map.

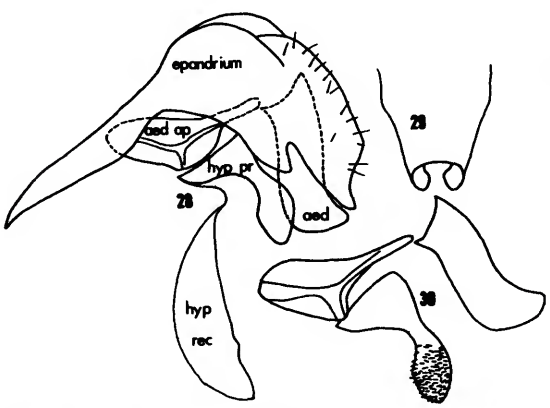
DIAGNOSIS.—Similarities between specimens of *N. nudipes, N. bella,* and *N. taenia* are evident and probably indicate a close relationship. However, specimens of *N. nudipes* may be distinguished from those of similar congeners by the following combination of characters: First and second antennal segments dark, mostly black but third segment mostly pale, yellow except for darker anterodorsal margin which is concolorous with basal segments; maculation pattern of abdominal segments of *N. nudipes* specimens more extensive and fifth abdominal segment almost as long as wide. Genitalia of *N. nudipes* males are very distinctive: epandrium very large and ventral half flexed at approximately a right angle to remaining portion; shape of hypandrial process, basiphallus, and aedeagal apodeme also characteristic (Figures 28–30).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.1 to 4.37 mm; with gray to brownish gray coloration and a few brown markings.

Head: Head ratio 1:0.78; postfrons ratio 1:0.86; frons mostly subdued gray although median triangular area and lateral margins generally lighter, concolorous. Paravertical bristles small, only slightly larger than postocellar setae. No proclinate, frontoorbital setae present. First and second antennal segments generally dark, third segment mostly pale except for darker anterodorsal margin; arista with 8–10 dorsal branches. Face very pale, whitish yellow; prefrons ratio 1:0.81; facial setae small, hairlike, numbering 2–4, on ventral half only. Eye ratio 1:0.81; eye-to-cheek ratio 1:0.21. Gena unicolorous throughout, slightly darker than facial color; genal bristle approximately twice length of paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Mesonotum mostly gray, although with some brownish coloration, slightly darker than pleural areas; lateral margin with distinct stripe extending from anterior of presutural bristle to supra-alar bristle area, brown. Lateral margin of scutellum blackish brown when viewed from posteroblique angle. Femora concolorous, gray, apically pale; tibiae and tarsi yellow. Setal fascicle of hind basitarsus pale, yellow. Wing ratio 1:0.45; costal vein ratio 1:0.52; M_{1+2} vein ratio 1:0.81.

Abdomen: Abdomen ratio of males 1:0.85; length of fourth tergum to fifth tergum ratio of males 1:1.9; fifth tergum ratio of males 1:0.78. Abdominal fascia brown, usually well marked and extensive,



FIGURES 28–30.—*N. nudipes:* 28, male genitalia, lateral aspect; 29, epandrial processes, posterior aspect; 30, internal male genitalia, lateral aspect (aed = aedeagus: aed ap = aedegal apodeme; hyp pr = hypandrial process; hyp rec = hypandrial receptacle).

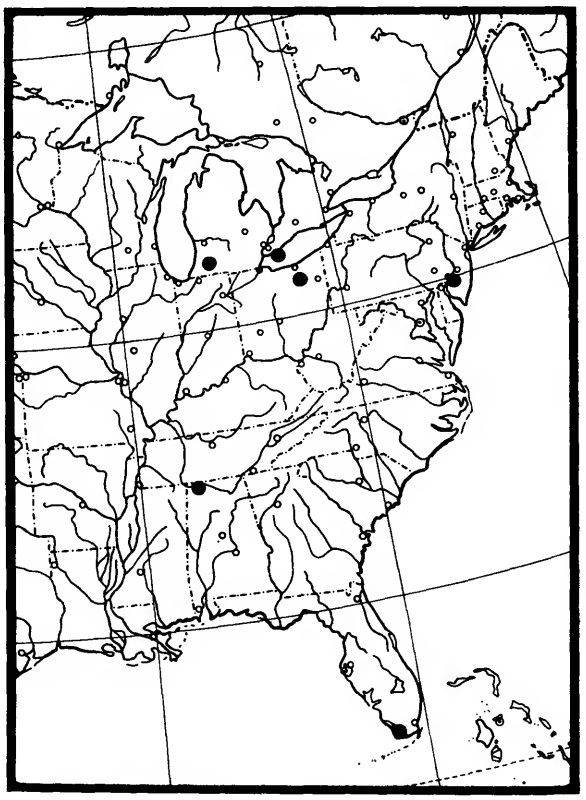


FIGURE 31.—*N. nudipes:* distribution map.

trigonal, sometimes reduced to fewer spots. Male terminalia as in diagnosis and in Figures 28–30.

SPECIMENS EXAMINED (56).—CANADA: ONTARIO: Point Pelee (CNC). UNITED STATES: ALABAMA: Lauderdale Co., Wilson Dam (USNM). FLORIDA: Monroe Co., Paradise Key (ANSP). MICHIGAN: Kalamazoo Co., Gull Lake Biological Station (MSU). OHIO: Summit Co., Akron (ANSP, OHSU).

GEOGRAPHIC DISTRIBUTION (Figure 31).—Apparently this species occurs throughout eastern North America, although collecting records are few. Collection dates are from 21 February to 5 July.

7. *Notiphila (Notiphila) pallicornis,* new species

FIGURES 32–33

DIAGNOSIS.—In most respects, specimens of *N. pallicornis* are similar to members of the *adusta* group but they also resemble taxa of the *avia* group. Of the species of the *adusta* group, they are similar to specimens of *N. adusta, N. biseriata,* and *N. footei.* Like *N. pallicornis,* specimens of these species have an enlarged hypandrial process that is apically covered with spinules. The general shape of the process varies, however, from species to species. In *N. pallicornis,* the process is more slender and not as heavily clothed with spinules. The conformation of the ventral epandrial process is also similar to that of *N. adusta* but differs in having the apices of the arms turned inward. The shape of the basiphallus of specimens of *N. pallicornis* is similar to that found in members of the *avia* group, being much longer than wide. See Figures 32–33. Externally, the entirely pale antennal segments are diagnostic.

DESCRIPTION.—Medium-sized shore flies as based on the length of the thorax; with grayish tan background coloration and a general absence of darker markings.

Head: Head ratio 1:0.71; postfrons ratio 1:0.55, frons generally unicolorous but with darker appearing broad stripes toward lateral margin of mesofrons when viewed from some angles; paravertical bristle only slightly larger than postocellar setae, much smaller than genal bristle; at most with 1 pair of small proclinate, fronto-orbital setae. Antennal segments entirely pale, bright yellow; arista with approximately 8–9 dorsal branches. Face nearly concolorous with frons, yellow but not appearing velvety from some angles; facial setae not strongly developed, mostly hairlike; prefrons ratio 1:0.63. Eye ratio 1:0.75; eye-to-cheek ratio 1:0.26. Gena moderately wide, concolorous with face anteriorly, becoming grayer posteriorly; genal bristle prominent, larger than paravertical bristle. Maxillary palpus pale, bright yellow.

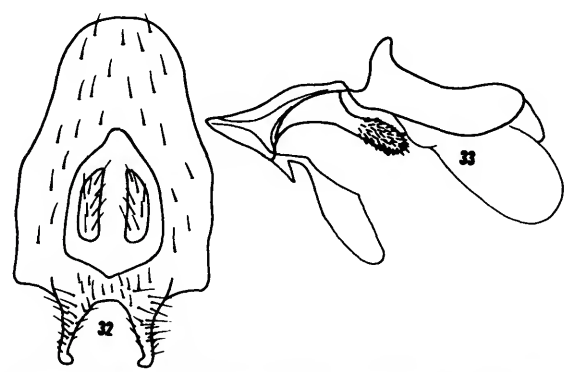
Thorax: Generally grayish tan and immaculate; dorsum concolorous with pleural areas. Femora dark except at apices, dusted gray; tibiae mostly dark; hind tibia with considerable pallor at apex; tarsi mostly pale, yellowish orange. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.43; costal vein ratio 1:0.45; M_{1+2} vein ratio 1:077.

Abdomen: Concolorous with thorax in general but with darker areas toward the anterior margin of each segment. The abdomen was removed before measurements were taken. Male genitalia as in diagnosis and in Figures 32–33.

TYPE-MATERIAL.—Holotype male: "Reindeer Depot Mackenzie Delta 17-VIII-1948 J. R. Vockeroth/HOLOTYPE Notiphila pallicornis Mathis (red)." Reindeer Depot is in the Northwest Territories, Canada. The type will be deposited with the Canadian National Collection, Ottawa, type number 15761.

ETYMOLOGY.—The epithet *pallicornis* is a combination of the Latin adjective *pallidus* ("pale" or "dim") plus the noun *cornu* ("horn") in reference to the distinctively pale antennae.

GEOGRAPHIC DISTRIBUTION.—*Notiphila pallicornis* is known only from the type-locality, Reindeer Depot, Mackenzie Delta, Northwest Territories.



FIGURES 32–33.—*N. pallicornis:* 32, epandrium, cerci, epandrial processes, posterior aspect; 33, internal male genitalia, lateral aspect.

8. *Notiphila (Notiphila) taenia*, new species

FIGURES 34–36

DIAGNOSIS.—*Notiphila taenia* is a member of the *adusta* group. Specimens are similar to those of *N. bella*, although they could also be easily confused with those of *N. nudipes*. Specimens of *N. taenia* may be distinguished from those of either congener, however, by the following combination of characters: Antennal segments mostly black except for basal third of apical segment, which tends to be pale, usually orange; fifth abdominal segment much wider than long; and male genitalia not as large or as angulate as *N. nudipes* members. The genitalic structures of males most closely resemble those of *N. bella* males, and care should be taken in distinguishing between them: Ventral process of epandrium in *N. taenia* males projecting further and narrower; basiphallus much longer and angulate; hypandrial process longer and not symmetrical. See Figures 34–35.

DESCRIPTION.—Medium-sized shore flies, length 3.0 to 3.65 mm; with gray to slightly brownish gray background coloration and a few brown markings.

Head: Head ratio 1:0.78; postfrons ratio 1:0.90; frons generally light brown, subdued, slightly pollinose, median triangle area and lateral margin lighter, grayer. Paravertical bristle small, only slightly larger than postocellar setae; no proclinate fronto-orbital setae present. Antennal segments mostly dark, black, except for basal third of third segment, which tends to be pale toward the base. Arista with approximately 9 dorsal branches. Face unicolorous, pale yellow; prefrons ratio 1:0.74; facial setae very weak, on ventral portion only. Eye ratio 1:0.88; eye-to-cheek ratio 1:0.18. Gena narrow; genal bristle about twice as long as paravertical bristle; gena generally concolorous with face although becoming slightly darker posteriorly. Maxillary palpus pale, yellow.

Thorax: Mesonotum generally unicolorous, lightly brownish gray, darker than pleural areas; lateral margin with distinct stripes extending from anterior of presutural bristle, across dorsum of notopleuron to area around supra-alar bristle. Scutellum with darkened lateral margin which is an extension of a mesonotal stripe beginning just before posterior interalar bristle, best viewed from posterodorsal angle. Mesopleuron with brown stripe along dorsal margin. Femora mostly gray, apically pale; tibiae and tarsi yellow. Setal fascicle of hind basitarsus entirely pale; yellow. Wing ratio 1:0.37; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:0.65.

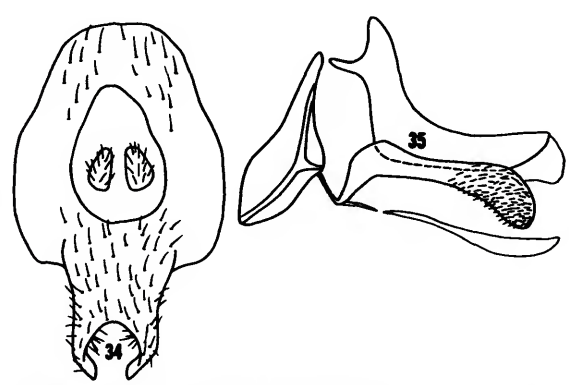
Abdomen: Abdomen ratio of males 1:0.74; length of fourth tergum to fifth tergum ratio of males 1:0.64; fifth tergum ratio of males 1:0.40. Segments with gray background color and with brown fascia which are usually distinct, trigonal. Male genitalia as in diagnosis and in Figures 34–35.

TYPE-MATERIAL.—Holotype male: "Gull Lake Biol. Sta., Kalamazoo Co., MICH, 23 June 1959, R.A. Scheibner/HOLOTYPE Notiphila taenia Mathis (red)." The allotype and six paratypes (4♂, 2♀) with the same label data as the type. Other paratypes as follows: 3♂, Flushing, N.Y., 30 V 1932, collector, C.H. Curran (ANMN); 1♂, 3♀, Manahawkin, V-30-10 NJ (New Jersey) (AMNH). The holotype will be deposited in the Michigan State University insect collection, East Lansing.

OTHER SPECIMENS EXAMINED.—(18). CANADA: ONTARIO: London (CNC); Point Pelee (CNC). UNITED STATES: MICHIGAN: Livingston Co., G. Res. (USNM). NEW JERSEY: Morris Co., Madison (USNM). NEW YORK: North Beach, Long Island (ANSP). OHIO: Carroll Co., Specht Marsh (KSU, USNM).

ETYMOLOGY.—The Latin noun *taenia* ("band" or "ribbon") refers to the lateral mesonotal stripes.

GEOGRAPHIC DISTRIBUTION (Figure 36)—*Notiphila taenia* occurs around the Great Lakes and eastward into New York and New Jersey. Collection dates are from 21 June to 4 July.



FIGURES 34–35.—*N. taenia*: 34, epandrium, cerci, epandrial processes, posterior aspect; 35, internal male genitalia, lateral aspect.

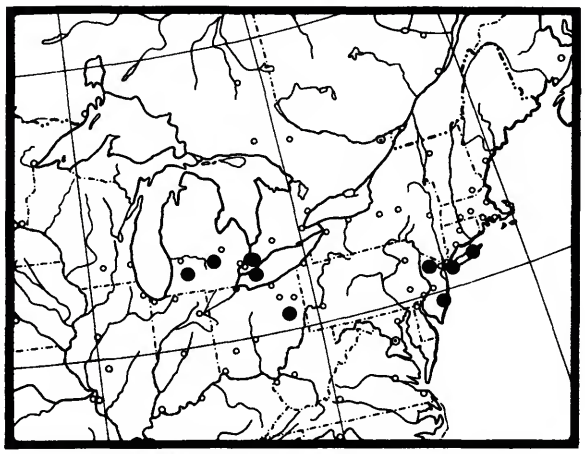


FIGURE 36.—*N. taenia:* distribution map.

REMARKS.—This species is often found sympatrically with *N. nudipes* but can be readily distinguished by the characters mentioned in the diagnosis and key. It is most similar to specimens of *N. bella;* however, the genitalia of the male are consistently different and are the primary evidence for recognizing it as a new species. The biology of this species is unknown.

The *avia* Group

SPECIES INCLUDED.—*Notiphila avia* Loew; *N. erythrocera* Loew; *N. phaeopsis,* new species; *N. pulchra,* new species; *N. robusta,* new species.

DIAGNOSIS.—Facial setation strong, bristlelike; setation of middle legs generally weak, especially the ciliate row of setae along ventral surface of tibia; most specimens large; and hypandrial process of male postabdomen short and wide (see species figures).

GEOGRAPHIC DISTRIBUTION.—*Notiphila avia* and *N. erythrocera* are the only members of this group that occur in western North America. The remaining species occur throughout eastern North America.

DISCUSSION.—With few exceptions, the species included here are the same as those Cresson placed in his "*riparia*-group." *Riparia* is not retained as the species-group name because it is unlikely that this species occurs in North America and because its identity is not clearly established.

This group has the fewest described species of the subgenus *Notiphila* in North America. Although few in number, the group is as heterogeneous as the other two groups of this subgenus. Specimens of *N. avia* and *N. robusta* are quite similar to each other and in addition to their affinities with other species of the *avia* group, they are both quite similar to *N. pallicornis* of the *adusta* group. Likewise, specimens of *N. pulchra* and *N. phaeopsis* are very similar to each other but also evidence some resemblance with *Notiphila* species from the Orient and Africa. *Notiphila erythrocera* is the outlier of the *avia* group, and specimens may be more similar to, and more conveniently placed in, a group of neotropical species, that has not yet been formalized.

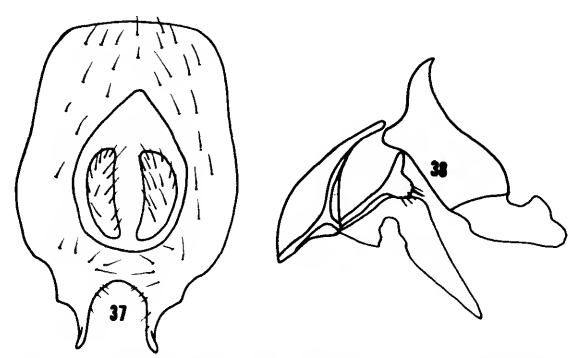
9. *Notiphila (Notiphila) avia* Loew

FIGURES 37–39

Notiphila avia Loew, 1878:193.
Notiphila (Notiphila) avia.—Cresson, 1946:236.

TYPE-MATERAL.—Holotype female: "H. B. T. (Hudson Bay Territory)/Loew Coll./avidm./Type 11135/Notiphila avia Lw, det W. Wirth '61." The holotype is deposited in the Museum of Comparative Zoology, Harvard University, type number 11135.

DIAGNOSIS.—Specimens of *Notiphila avia* are very similar to those of *N. robusta* and are best distinguished from the latter only after comparing differences in the male genitalia (Figures 37–38). Externally, the third antennal segment of specimens of *N. avia* is often mostly pale, yellowish orange, and in many specimens it is entirely so.



FIGURES 37–38.—*N. avia:* 37, epandrium, cerci, epandrial processes, posterior aspect; 38, internal male genitalia, lateral aspect.

DESCRIPTION.—Moderately large to large shore flies, 4.0 to 5.60 mm in length; with grayish brown to light brown background coloration and few darker markings.

Head: Head ratio 1:0.73; postfrons ratio 1:0.61; frons generally unicolorous or median triangle area slightly lighter in color, pollinose, area immediately laterad of median triangle often tinged with some charcoal coloration. Paravertical bristle large, approximately twice the length of postocellar setae; usually without distinguishable, proclinate, frontoorbital setae or at most with 1 pair. First and second antennal segments dark, usually black; third antennal segment variable, mostly pale but darkened apically and dorsally; arista with 8–10 dorsal branches. Face little differentiated from frons in color, lighter; facial setae strong, bristlelike, numbering 3–4; prefrons ratio 1:0.95. Eye ratio 1:0.77; eye-to-cheek ratio 1:0.28. Gena wide; genal bristle distinct, subequal to paravertical bristle. Maxillary palpus pale.

Thorax: Generally unicolorous, some specimens with slight indication of median mesonotal stripe or with maculation area on mesopleuron. Femora, tibiae, and front tarsi dark, black but pale apically; middle and hind tarsi pale. Setal fascicle of hind basitarsus dark, Wing ratio 1:0.42; costal vein ratio 1:0.35; M_{1+2} vein ratio 1:0.72.

Abdomen: Abdomen ratio of males 1:0.74; length of fourth tergum to fifth tergum of males 1:0.80; fifth tergum ratio of males 1:0.57. Abdominal terga fasciated, although weakly, with darker, blackish brown coloration. Female terminalia composed of well sclerotized segments 6, 7, and 8. Male terminalia as in diagnosis and in Figures 37–38.

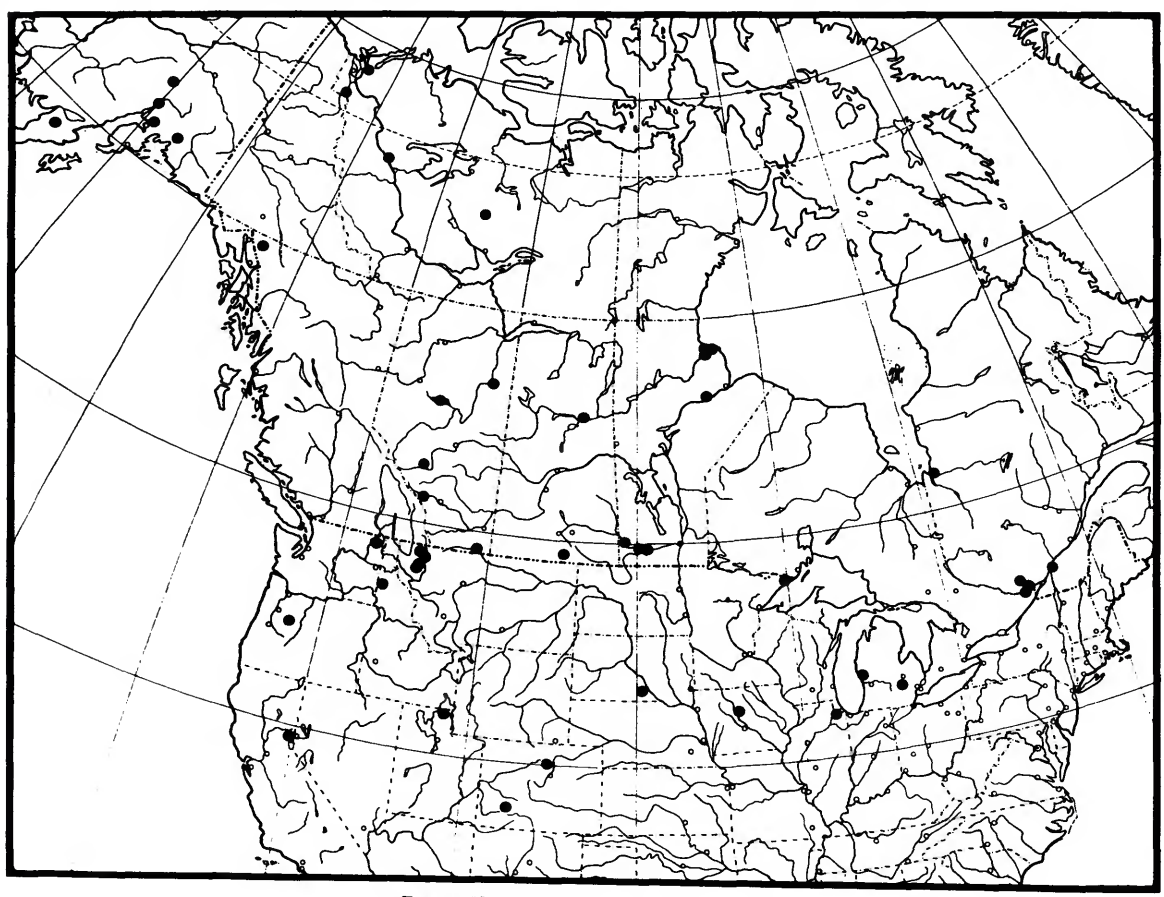


FIGURE 39.—*N. avia:* distribution map.

SPECIMENS EXAMINED (273).—CANADA: ALBERTA: Banff (CNC); Lesser Slave Lake (USNM); McMurray (CNC); Nordegg (ANSP). BRITISH COLUMBIA: Ledum-Kalmia bog (CNC); Port Rupert (CNC). MANITOBA: Assiniboine River-Treesbank (CNC); Brandon (CNC); Churchill (CNC); Eastern Creek near Church (CNC); Farnsworth Lake near Churchill (CNC); Gillam (CNC); 8 km SW Shilo (CNC); Warkworth Creek near Churchill (CNC); Farnsworth Lake near Churchill CNC); Exmouth Lake, 65°0.2'N, 115°54'W (CNC); Fort McPherson (CNC); Fort Smith (CNC); Norman Wells (CNC). ONTARIO: Ottawa (CNC); Mer Bleue (CNC). QUEBEC: Berthierville (AMNH); Kazubazua (CNC); Montebello (AMNH); Rupert House (CNC). SASKATCHEWAN: Waskesiu River (USNM); Willows, 49°37'N, 105°52'W (CNC). YUKON TERRITORY: Otter Lake, 130°25'W, 62°30'N (CNC); Swim Lakes, 133°63'W (CNC). UNITED STATES: ALASKA: Anchorage, 48.3 km NE (USNM); 32.2 km W Glennallen (KSU); King Salmon-Naknek River (CNC); Matanuska Valley (CU, USNM); McKinley National Park near Teklanika Campground (KU). CALIFORNIA: Nevada Co., 1.6 km NW Hobart Mills (WNM); 4 km NW Hobart Mills (WNM). COLORADO: Boulder Co., Nederland (CSU); Mineral Co., Creede (KSU). IDAHO: Latah Co., Potlatch (ANSP). ILLINOIS: Du Page Co., Glen Ellyn (USNM). IOWA: Hamilton Co., Little Wall Lake (USNM). MICHIGAN: Livingston Co., Game Reserve (MSU, USNM); Muskegon Co. (USNM). MINNESOTA: Eaglenest (USNM); Cook Co., Grand Marais (UMN). MONTANA: Flathead Co., 1.6 km W Bigfork (KSU, USNM), 9.7 km NW Bigfork (KSU), 16.1 km NW Bigfork (KSU), 53.1 km N West Glacier (KSU), 8 km ENE Kalispel (KSU); Glacier Co., 3.2 km E Babb (USNM), Glacier National Park-Avalanche Campground (USNM); Lake Co., 3.7 km E Polson (WNM), 4.8 km E. Polson (KSU), 24.2 km NE Polson (KSU), 4.8 km S Ronan (KSU, USNM), 5.2 km S Ronan (WNM), 1.6 km S Swan Lake (KSU), 8 km S Swan Lake (KSU), 4.8 km S Swan Lake (USNM), University of Montana Biological Station (MSU). OREGON: Linn Co., 33.8 km SE Idanha (WNM), 41.9 km SE Idanha (WNM). SOUTH DAKOTA: Tripp Co., Winner (ANSP). UTAH: Duchesne Co., Ashley National Forest-Lime Kiln Spring (WNM). WASHINGTON: Ferry Co., 24.2 km W Kettle Falls (UN).

GEOGRAPHIC DISTRIBUTION (Figure 39).—*Notiphila avia* ranges throughout the northern half of North America. This is one of the few species of the subgenus *Notiphila* that occurs in the West, as far south as California, although usually at higher elevations. It has been collected from 28 May to 24 August.

REMARKS.—In western North America, the third antennal segment of *N. avia* members is mostly dark, often entirely black, whereas in specimens from the East this segment has considerably more pallor. Often the posteroventral portion is pale orange, and in some specimens, most of the segment is pale.

This species has been collected from grass meadow habitats near lotic aquatic systems in mountainous areas. Collecting was particularly productive around beaver ponds.

10. *Notiphila (Notiphila) erythrocera* Loew

FIGURES 6–8, 40–43

Notiphila erythrocera Loew, 1878:194.
Notiphila varia Jones, 1906:153. [Synonymy by Cresson, 1917: 36.]
Notiphila (Notiphila) erythrocera.—Cresson, 1917:36.

TYPE-MATERIAL.—Lectotype female (here designated): "(a small, silver-colored square) Loew Coll./ erythrocera m./Type 11132 (red)/LECTOTYPE Notiphila erythrocera Loew by W. N. Mathis." Loew's original description states that Cuba is the type-locality, although a locality label indicating such does not accompany the type specimen. The lectotype is deposited in the Museum of Comparative Zoology, Harvard University, type number 11132. I have also examined the lectotype of the junior synonyn, *N. varia* (designated by Mathis, 1974), which bears the following label data: "Riverside, Riverside Co., V–30–(18)98, Cal(ifornia)"; Cresson's determination label dated 1915; Wirth determination label without a date; a blue paratype label written by Cresson; "1134/♂/LECTOTYPE Notiphila varia Jones, Wayne N. Mathis, 1848." The lectotype of the junior synonym is deposited with the California Academy of Sciences, San Francisco, type number 1848.

DIAGNOSIS.—*Notiphila erythrocera* is one of the most variable species of *Notiphila* and specimens could easily be confused with those of similar congeners. However, specimens may be distinguished from all others by the following combination of characters: Antennal segments usually pale, light orange, although first and second segments often with some darkened areas; usually with 11–12 aristal bristles; facial setae well developed, bristle-like, but few in number, 3–4; overall color and maculation pattern varying considerably but in general coloration cinereous to ochraceous and with some dark brown maculations on the abdomen. Structures of the male genitalia distinctive: Arms of ventral process of epandrium setulose and projecting forward from epandrium without any basal development; arms forming a broad, deep, U-shaped structure. See Figures 40–42.

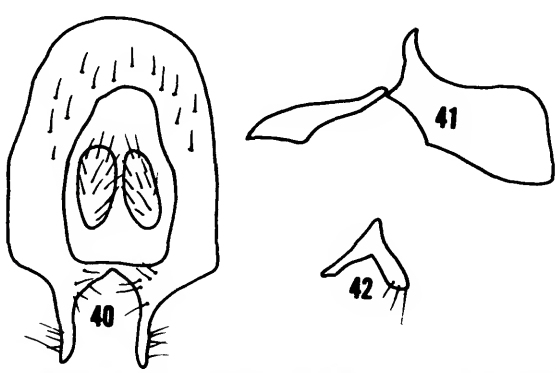
DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.00 to 4.25 mm; with cinereous

to ochraceous coloration and a few darker brown markings.

Head: Head ratio 1:0.72; postfrons ratio 1:0.61; frons generally light brown, pollinose, median triangular area and lateral margins lighter in color, concolorous. Paravertical bristle large, nearly twice the size of postocellar setae; 1 pair of proclinate, fronto-orbital setae generally present. Antennal segments mostly pale, yellowish orange, but often with some darkened areas on basal segments; arista with 10–12 dorsal branches. Face yellowish gray to almost whitish gray; facial setae strong, bristlelike, numbering 3–4; prefrons ratio 1:0.88. Eye ratio 1:0.79; eye-to-cheek ratio 1:0.25 Gena moderately narrow, mostly concolorous with face becoming grayer and slightly darker posteriorly; genal bristle subequal to paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Mostly light brown, cinereous to ochraceous, mesonotum usually darker than pleural areas. Both mesonotum and mesopleuron generally without any maculation areas but sometimes there are faint indications. Femora (Figures 6–7) mostly gray, with some darkened areas, apically pale; tibiae and tarsi pale, yellow; front tibia sometimes slightly darkened. Setal fascicle of hind basitarsus dark (Figure 8). Wing ratio 1:0.41; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:0.83.

Abdomen: Abdomen ratio of male 1:0.79; length of fourth tergum to fifth tergum ratio of males 1:0.78; fifth tergum ratio of males 1:0.43. Usually with some maculation pattern of darker brown areas, guttate, but often nearly immaculate. Male terminalia as in Figures 40–42.



FIGURES 40–42.—*N. erythrocera:* 40, epandrium, cerci, epandrial processes, posterior aspect; 41, internal male genitalia, lateral aspect; 42, hypandrial process, ventral aspect.

SPECIMENS EXAMINED (513).—ALABAMA: Mobile Co., Coden (USNM), Kushla (USNM), Mobile (USNM). ARIZONA: St. Zavier Mtn. (CAS); Apache Co. (KU); Cochise Co., Huachuca Mountains-Sunnyside Canyon (KU, USNM); Gila Co., E Verde River, 8 km N Payson (WNM); Pima Co., Lowell Ranger Station (AMNH, USNM); Santa Cruz Co., Patagonia (USNM), 9.7 km E Patagonia-Sonoita Creek (KSU). CALIFORNIA: Colusa Co., Maxwell (UCD); Inyo Co. (UCR); Kern Co., Rosamond (KU); Los Angeles Co., Los Angeles River (ANSP), Sangus (ANSP, WSU); Mono Co., Mono Lake (USNM), 3.2 km N Mono Lake (WNM); Orange Co., Anaheim (ANSP); Riverside Co., Lake Hemet (USNM), Riverside (UCB, ANSP, USNM), Temecula (UCB); San Bernardino Co., Chino (USNM), Redlands (USNM); San Diego Co., Jacumba (KU), Lake Henshaw (USNM); Sutter Co., Live Oak Park (USNM). COLORADO: Chaffee Co. (ANSP, CSU); El Paso Co., Monument (ANSP); Fremont Co. (KNSU); Jefferson Co., Golden (USNM); Larimer Co., Fort Collins (ANSP, CSU), La Porte (CSU); Weld Co., Roggen (CSU). DELAWARE: Sussex Co., Rehoboth (ANSP, USNM). FLORIDA: Hibernia (KU); Little River (ANSP); Alachua Co. (FSCA), Gainesville (KU, USNM); Dade Co., Biscayne Bay (ANSP), Miami (CNC); DeSoto Co., Fort Ogden (CNC); Duval Co., Jacksonville (CU); Franklin Co., 3.2 km W Apalachicola (UMI); Glades Co., Palmdale-Fisheating Creek (CU); Gulf Co., Beach at McNeil's (UMI); Highlands Co., Archbold Biological Station, 16.1 km S Lake Placid (CU, UN, PSU). Highlands Hammock State Park (CU), Sebring (FSCA, MCZ); Hillsborough Co., Tampa (USNM); Levy Co. (FSCA, USNM); Marion Co., Silver Springs (USNM); Okaloosa Co. (FSCA); Orange Co., Orlando (ANSP, USNM); Osceola Co., Kissimmee (USNM); Palm Beach Co., Lake Worth (AMNH, USNM); Pasco Co., Hudson (KU); Pinellas Co., Saint Petersburg (CU); Polk Co., Lakeland (ANSP, CU); Saint Johns Co., 0.6 km N Marineland (CU), Saint Augustine (ANSP, MCZ); Sarasota Co., Myakka River State Park (FSCA, USNM); Volusia Co. (FSCA), Ormond (AMNH). GEORGIA: Glynn Co., Thalmann (ANSP, CU); Liberty Co., North Newport River-Riceboro (ISU), Saint Catherines Island (AMNH). LOUISIANA: Cameron Parish, Cameron (ANSP, OHSU, WSU), 24.2 km E Creole (KU); Iberville Parish, Sunshine (FSCA); Jefferson Parish, Harahan (MCZ); Orleans Parish, New Orleans (ANSP); Saint Charles Parish, W. Bonnet Carre Spillway (CU); Saint Tammany Parish, Manderville (KU), Sidell (ANSP, OHSU). MARYLAND: Calvert Co., Chesapeake Beach(USNM). NEBRASKA: Box Butte Co., Alliance (UN); Chase Co., Champion (UN); Cherry Co., Snake Falls (USNM). NEVADA: Washoe Co., Sparks (USNM), Steamboat (USNM). NEW JERSEY: Cape May Co., Cape May (ANSP). NEW MEXICO: Catron Co., Apache Creek (WNM); Eddy (KU); Grant Co., Mangus Springs, 17.7 km S Cliff (WNM); San Juan Co., 1.6 km S Bloomfield (WNM); San Miguel Co., 0.8 km NE Montezuma (WNM). OREGON: Harney Co., Crane Hot Springs (WNM), Harney Lake (USNM); Lake Co., Ana Reservoir (WNM), Summer Lake (WNM), 7.7 km N Summer Lake (WNM), Warner Canyon (WNM). SOUTH CAROLINA: Charleston Co., Wedge Plantation, 11.3 km NE McClennanville (CU); Horry Co., Myrtle Beach (USNM). TEXAS: Victoria (USNM); Bexar Co., San Antonio (USNM); Cameron Co., Harlington (USNM), Laguna Madre, 40.3 km SE Harlingen (ISU, USNM); Galveston Co.,

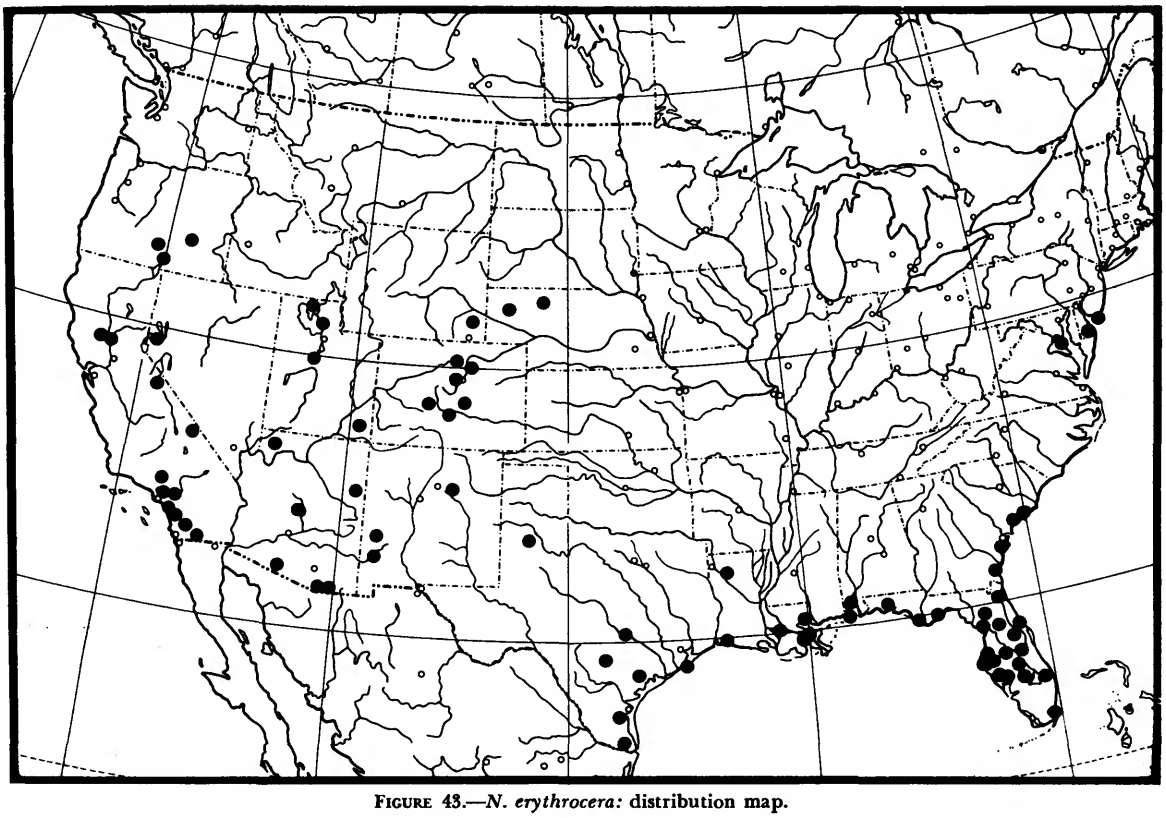


FIGURE 43.—*N. erythrocera:* distribution map.

Dickinson (ANSP), Galveston (ANSP, USNM); Hildalgo Co., McAllen (USNM); Kenedy Co., Sarita (INHS); Lubbock Co., Buffalo Spring Lake (USNM); Travis Co., Austin (USNM). UTAH: Box Elder Co., Brigham City (USU); Davis Co., Farmington (USNM), Syracuse (USU); San Juan Co., 3.2 km S Blanding (WNM); Utah Co., Elberta (ANSP), Goshen Pond (WNM). WYOMING: Platte Co., Chugwater (ANSP, USNM).

GEOGRAPHIC DISTRIBUTION (Figure 43).—*Notiphila erythrocera* occurs throughout most of the southern half of North America below the 45th parallel. In the West, it is found as far north as Oregon and Wyoming. Collection dates are from 1 January to 24 October.

REMARKS.—This is a variable species, although the genitalia of males from throughout its distribution are consistently similar. There are a few populations from the Southeast in which specimens are almost white in background coloration and have very light maculation areas. These populations could represent a distinct subspecies or species. Most specimens are light tan with darker brown, guttate markings on the abdomen.

Specimens of *N. erythrocera* have been collected from sedge-meadow and reed-marsh habitats.

11. *Notiphila (Notiphila) phaeopsis*, new species

FIGURES 44–48

DIAGNOSIS.—Although similar to specimens of *N. pulchra*, those of *N. phaeopsis* may be distinguished by the following combinations of characters: Specimens in general darker brown and more uniformly colored; face and frons nearly concolorous; first and second antennal segments dark brown, third segment mostly dark although its base often lighter, generally orange; maculation pattern on thorax not as evident, especially darkened spot on mesopleuron; thorax generally more uniformly colored; darkened fascia on abdominal segments extending to lateral margins without being interrupted by lighter areas; femora and tibiae dark brown, lighter apical and basal areas not nearly as extensive; epandrial process of male postabdomen bluntly rounded, short,

and not diverging apically; lobe of hypandrial process apically rounded.

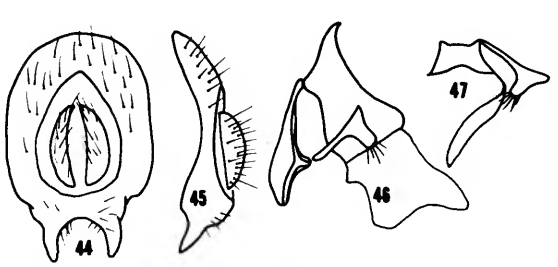
DESCRIPTION.—Medium-sized shore flies, length 3.54 to 3.90 mm; uniformly dark colored, brown.

Head: Head ratio 1:0.70; frons and face uniformly concolorous, dark brown, lightly pollinose; postfrons ratio 1:0.77; paravertical bristle large, subequal to proclinate, anterior ocellar bristles. First and second antennal segments dark brown to blackish brown; third segment orange basally, becoming dark apically; dorsal aristal branches numbering 10–14. Facial setae hairlike, subequal to postocellars; prefrons ratio 1:0.78. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.16; genal bristle subequal to facial setae, gena lighter in color than prefrons, becoming gray posteriorly. Maxillary palpus pale apically, yellow, basally darkened.

Thorax: Uniformly dark brown, concolorous with head. Propleural area and posterior area of mesothorax gray. Femora and tibiae dark brown although not pollinose, apices usually light in color, yellowish. Tarsi mostly yellow but with darkened, brown-colored areas, especially on dorsal surfaces. Setal fascicle of hind basitarsus black. Wing ratio 1:0.40; costal vein ratio 1:0.39; M_{1+2} vein ratio 1:0.68.

Abdomen: Darkened fascia occupying most of terga except for posterior margins, which are bluish gray. Male terminalia as in diagnosis and Figures 44–47.

TYPE-MATERIAL.—Holotype male: "Iowa, Hamilton Co. Goose Lake VII–14–1960 D. L. Deonier/ HOLOTYPE Notiphila phaeopsis Mathis (red)." Allotype female: "Iowa, Hancock Co., Pilot Knob St. Park, June 24, 1966, H. Borchers (USNM)." Other paratypes as follows: 1 ♀, Michigan, Detroit, 1 Aug 1939, Geo. Steyskal (ANSP); 1 ♀, New York, Oswego Co., St. Mary's Pond, 16 Jul 1968, K. W. Simpson coll. (CU); 1 ♀, Suffolk Co., Long Island, Orient, 15 Sep 1948, Roy Latham (USNM); 1 ♀, Cayuga Co., Ontario Beach, N. Fair Haven, 7 Jul 1922, L. S. West (CU). The holotype will be deposited with the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73553.



FIGURES 44–47.—*N. phaeopsis:* 44, epandrium, cerci, epandrial processes, posterior aspect; 45, same, lateral aspect; 46, internal male genitalia, lateral aspect; 47, hypandrial process and hypandrial receptacle, ventral aspect of one side.

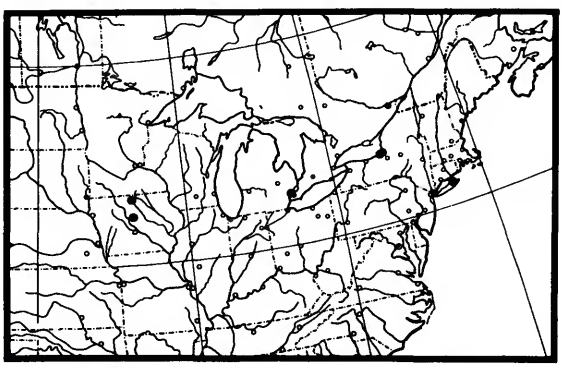


FIGURE 48.—*N. phaeopsis:* distribution map.

ETYMOLOGY.—The epithet *phaeopsis* is derived from the Greek *phaios* ("dusky" or "brown") plus *opsis* ("appearance" or "countenance") in allusion to the general dark brown coloration of this species.

GEOGRAPHIC DISTRIBUTION (Figure 48).—From the few locality records available, *N. phaeopsis* occurs in midwestern and northeastern United States. Collection dates are from 24 June to 15 September.

12. *Notiphila (Notiphila) pulchra,* new species

FIGURES 49–51

Notiphila (Notiphila) riparia.—North American authors [not Meigen, 1830:65].

DIAGNOSIS.—Specimens of this species are not likely to be confused with any others except possibly for those of *N. phaeopsis. Notiphila pulchra* specimens are distinguished from those of *N. phaeopsis* and of all other species by the following combination of characters: Antennal segments entirely pale or at most first segment darkened; arista bearing up to 15 dorsal aristal branches; facial series of setae well developed, bristlelike; mesonotum without a median stripe but with a small spot just anterior of presutural bristle; mesopleuron also bearing darker maculation area; characteristic setal comb along posteroventral margin of middle femur very

weakly developed and lacking distinctive row of setae on middle tibiae; specimens are generally grayer in background coloration than those of *N. phaeopsis;* male genitalia also very diagnostic (Figures 49–50).

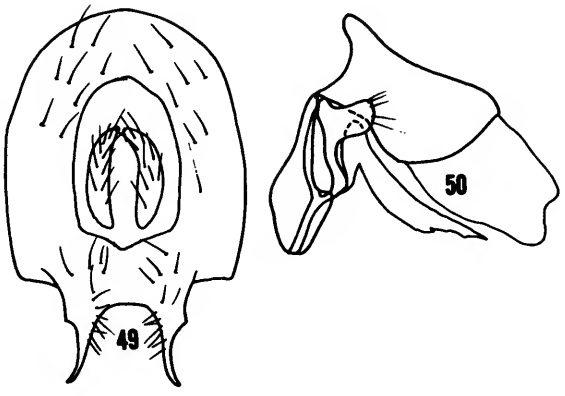
DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.65 to 4.82 mm; with dark gray to brownish gray background coloration and dark brown markings.

Head: Head ratio 1:0.70; postfrons ratio 1:0.61; frons mostly gray but median triangular area lighter, brown, lateral margins sometimes concolorous with median triangular area but often dark, like remainder of the frons. Paravertical bristle very large, in some specimens equaling ocellars in size; 1 pair of proclinate, fronto-orbital setae usually present but never strongly developed. Antennal segments mostly pale, yellowish orange, occasionally the basal segment is darkened; arista with 10–15 dorsal branches. Face gray and often with median, brown stripe on lower two-thirds, facial setae strongly developed, numbering 3–4, restricted to lower half of face; prefrons ratio 1:0.73. Eye ratio 1:0.73; eye-to-cheek ratio 1:0.16. Gena narrow, generally concolorous with face; genal bristle strong, almost equal to paravertical bristles. Maxillary palpus pale, yellowish orange to yellow.

Thorax: Mesonotum mostly gray to brownish gray and immaculate except for a small, darker spot just anterior to presutural bristle. Disc of scutellum usually slightly lighter in color. Mesopleuron often with darker maculation area. Femora and tibiae dark, usually black, both pale apically; tarsi mostly pale; setal comb along posteroventral margin of middle femur weakly developed or absent; no evidence of a distinct row of setae along the middle tibia. Setal fascicle of hind basitarsus black. Wing ratio 1:0.48; costal vein ratio 1:0.51; M_{1+2} vein ratio 1:0.57.

Abdomen: Abdomen ratio of males 1:0.72; length of fourth tergum to fifth tergum ratio of males 1:0.74; fifth tergum ratio of males 1:0.49. Abdomen generally dark gray but with darker brown-gray, guttate markings of large size. Male terminalia as in Figures 49–50.

TYPE-MATERIAL.—Holotype male: "Goose Lake Hamilton Co. Iowa VIII–14–1960/D. L. Deonier/HOLOTYPE Notiphila pulchra Mathis (red)." Allotype female and six paratypes (5♂, 1♀): with same locality data as the holotype (ISU, USNM, WNM). The holotype will be deposited with the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73551.



FIGURES 49–50.—*N. pulchra:* 49, epandrium, cerci, epandrial processes, posterior aspect; 50, internal male genitalia, lateral aspect.

OTHER SPECIMENS EXAMINED (69).—CANADA: ONTARIO: Dundas Marsh (CNC); Marmora (CNC). UNITED STATES: FLORIDA: Royal Palm Park (USNM); Alachua Co., Gainesville (CNC, FSCA); DeSoto Co., Brownville (USNM); Franklin Co., Beach, 3.2 km W Apalachicola (UMI); Highlands Co., Archbold Biological Station (PSU); Polk Co., Lakeland (ANSP). GEORGIA: Okefenokee Swamp, Billy's Island (CU); Okefenokee Swamp, Honey Island (CU); Okefenokee Swamp (CU); Glynn Co., Thalman (CU). ILLINOIS: Johnson Co., Goreville (MSU). KANSAS: Stafford Co. (ANSP). LOUISIANA: East Baton Rouge Parish, Baton Rouge (USNM). MASSACHUSETTS: Middlesex Co., Concord (USNM); Nantucket Co., Nantucket (ANSP). MICHIGAN: Bay Co. (USNM); Monroe Co., Monroe (ANSP, USNM). MISSOURI: Saint Louis Co., Webster Groves (USNM). NEW JERSEY: Essex Co., Newark (ANSP). NEW YORK: Cayuga Co., Auburn (USNM); Niagra Co., Olcott (USNM); Queens Co., Flushing (AMNH); Tompkins Co., Ithaca (ANSP, CU). OHIO: Carroll Co., Specht (KSU); Erie Co., Sandusky-Cedar Point (ANSP, OHSU); Hamilton Co., Cincinntti (OHSU); Portage Co., Kent (OHSU), 4.8 km E Kent (FSU), Mogodore Reserve (KSU); Wayne Co., 0.8 km S Rittman (KSU, USNM). TENNESSEE: Knox Co., Knoxville-University Farm (CNC). TEXAS: Val Verde Co., Del Rio-Devil's River (CNC).

ETYMOLOGY.—The epithet *pulchra* is derived from the Latin adjective *pulcher* ("noble," "fine," or "fair") referring to the handsome appearance of this fly.

GEOGRAPHIC DISTRIBUTION (Figure 51).—*Notiphila pulchra* occurs throughout most of eastern North America. It extends northward into Ontario, Canada, and southward into Florida. Collection dates are from 25 March to 8 October.

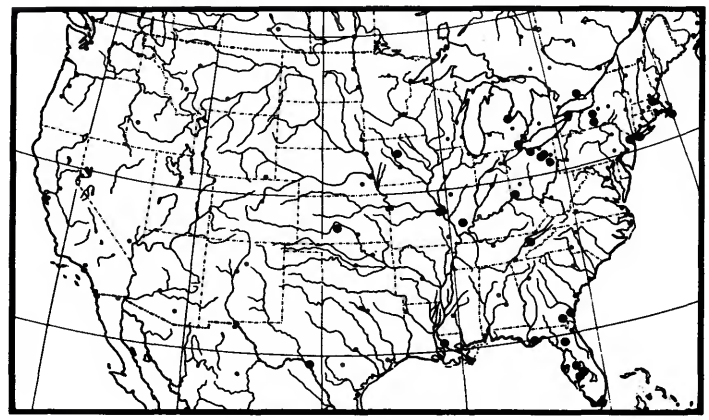


FIGURE 51.—*N. pulchra:* distribution map.

REMARKS.—*Notiphila pulchra,* in North America, has been known as *N. riparia* Meigen since it was first discovered. After examining European specimens that were labeled *N. riparia,* after comparing figures of the ventral epandrial process of nearctic material with illustrations or photographs of the same by Dahl (1964, 1972), and after Dr. Loïc Matile, (Laboratorie d'Entomologie Générale et Appliquée Paris) compared nearctic specimens, which I sent him, with two extant syntypes of *N. riparia,* I have concluded that the North American species is distinct from *N. riparia.* There is no other available name for this species, so it is being named here.

Dr. Matile pointed out (pers. comm.) several differences between the syntypes and the specimens I sent from Michigan. He also mentioned that one of the syntypes had four dorsal extensor bristles on the middle tibia, which is a key character for some members of the subgenus *Dichaeta.* Both syntype specimens are damaged. Establishing the true identity of N. riparia will depend on a thorough revision of the European fauna of *Notiphila.*

13. *Notiphila (Notiphila) robusta,* new species

FIGURES 52–54

DIAGNOSIS.—This species belongs to the *avia* group wherein it is closely allied to *N. avia.* Externally, the differences between specimens of *N. robusta* and those of *N. avia* are slight and reference to characters of the male genitalia will usually be necessary to distinguish one from the other. Except for a very thin basal edge of light coloration, the third antennal segment is almost entirely dark. Many specimens of *N. avia* have darkened third antennal segments, especially in the West, but this is not the usual character state for specimens from near the type-locality of *N. robusta.* Several structures of the male genitalia are diagnostic. The shape of the ventral epandrial process, hypandrial process, and basiphallus is characteristic of this species. See Figures 52–54.

DESCRIPTION.—Moderately large shore flies based on the length of the thorax; with grayish tan coloration and few contrasting, darker areas.

Head: Head ratio 1:0.74; postfrons ratio 1:0.63; frons mostly unicolorous, brown with some gray pollinosity, except for lighter brown median triangular areas surrounding ocellar triangle; paravertical bristle subequal with genal bristle. Antennal segments mostly dark brown to black, base of third segment with narrow margin of contrasting lightened area; arista with 8 dorsal branches. Face lighter than frons, yellow; prefrons ratio 1:0.89; facial setae strong, subequal to genal bristle, numbering 2–3. Eye ratio 1:0.74; eye-to-cheek ratio 1:0.25; gena moderately wide, uniformly unicolorous, slightly grayer than face, genal bristle distinct but not more strongly developed than facial setae. Maxillary palpus pale, yellow.

Thorax: Coloration grayish brown with some faint tinges of darker coloration, generally immaculate; pleural areas not distinctly contrasting in color with mesonotum, immaculate. Femora dark, dusted gray, pale apically; tibiae dark except at apices;

front tarsomeres dark, concolorous with front tibia; middle and hind tarsi appearing somewhat dark on anterior surface, otherwise with considerable pallor. Setal fascicle of hind basitarsus dark, black. Wing ratio 1:0.36; costal vein ratio 1:0.33; M_{1+2} vein ratio 1:0.71.

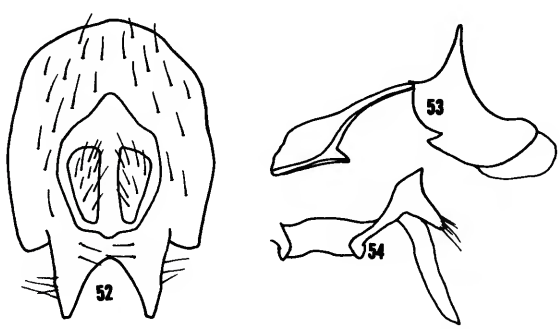
Abdomen: —Generally concolorous with thorax but with some darkened areas dorsally although these are not distinct, blending marginally. The abdomen was removed before measurements were taken. Male genitalia as in diagnosis and Figures 52–54.

TYPE-MATERIAL.—Holotype male: "Mi 61 Rte. 58 La Verendrye Prov(incial). P(ar)k. Que(bec). 26 VI 1965, D. M. Wood/HOLOTYPE Notiphila robusta Mathis (red)." The holotype will be deposited with the Canadian National Collection, Ottawa, type number 13774.

ETYMOLOGY.—The epithet is the Latin adjective *robusta* ("strong" or "robust") referring to the large size of this species.

SPECIMENS EXAMINED.—This species is known only from the male holotype.

GEOGRAPHIC DISTRIBUTION.—The type-locality is the only site where this species has been collected.



FIGURES 52–54.—*N. robusta:* 52, epandrium, cerci, epandrial processes, posterior aspect; 53, internal male genitalia, lateral aspect; 54, hypandrial process and hypandrial receptacle, ventral aspect of one side.

The *loewi* Group

SPECIES INCLUDED.—*Notiphila carinata* Loew; *N. cressoni*, new name; *N. eleomyia*, new species; *N. floridensis* Cresson; *N. latigena*, new species; *N. loewi* Cresson; *N. oriens*, new species; *N. pauroura*, new species; *N. poliosoma*, new species; *N. shewelli*, new species; *N. solita* Walker; *N. unicolor* Loew.

DIAGNOSIS.—The hypandrial process is short, narrow, and usually bears 2–3 apical setae; the facial setae are weakly developed.

GEOGRAPHIC DISTRIBUTION.—All described species of this group occur in eastern North America, mostly east of the Mississippi River.

14. *Notiphila (Notiphila) carinata* Loew

FIGURES 5, 55–59

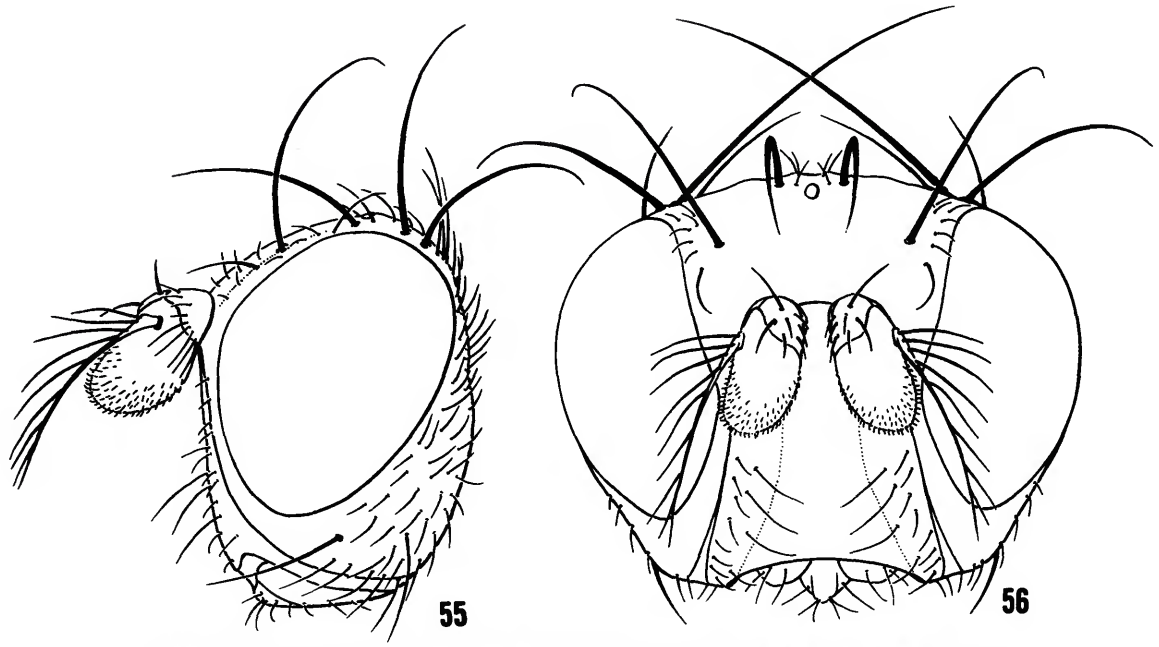
Notiphila carinata Loew, 1862:137.
Notiphila (Notiphila) carinata.—Cresson, 1946:235.

TYPE-MATERIAL.—Holotype female: "Mittel St. (green)/Loew Coll./carinata ♀/Type 11133 (red)." The holotype is in the Museum of Comparative Zoology, Harvard University, type number 11133.

DIAGNOSIS.—This species is a member of the *loewi* group but specimens are not likely to be confused with most of the included species because of their small size. Specimens of *N. carinata* resemble those of *N. cressoni* and *N. orienta* but may be distinguished from members of either of the latter species as follows: Mesopleuron usually with a rather well defined, darkened area; mesonotum immaculate. Male genitalia are very diagnostic: Ventral process of epandrium widely U-shaped and not curved apically; arms of ventral process not sinuate; basiphallus short, with an expanded apex (Figures 57–58).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.58 to 3.56 mm, with grayish brown to light brown background coloration and a few brown markings.

Head (Figures 55–56): Head ratio 1:0.78; postfrons ratio 1:0.64; most of frons light brown, pollinose, median triangular area and lateral marking lighter, concolorous. Paravertical bristle large, approximately double length of postocellars; at most with one proclinate, fronto-orbital seta. Antenna mostly darkened, dark brown, third segment with basal half, especially posteroventral portion, pale, yellow; arista with 8–9 dorsal branches. Face unicolorous, light yellow, dusted lightly; prefrons ratio 1:0.69; facial setae small, hairlike. Eye ratio 1:0.83; eye-to-cheek ratio 1:0.155. Gena narrow, generally concolorous with face, especially anteriorly, becoming grayer posteriorly; genal bristle approximately subequal to

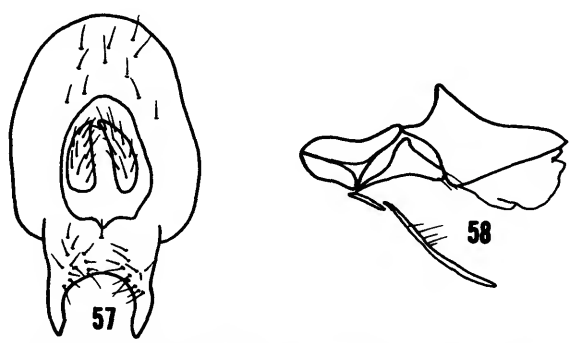


FIGURES 55–56.—*N. carinata:* 55, head, lateral aspect; 56, same, anterior aspect (scale = 0.25 mm).

paravertical bristle. Maxillary palpus pale, yellowish orange.

Thorax: Mesonotum light brown, darker than pleural area, generally immaculate. Mesopleuron with darkened brown spot. Femora (Figure 5) gray with some darkened areas along dorsum; tibiae generally concolorous although front pair slightly darkened, often with darkened preapical spot to ring; tarsi pale, yellow. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.45; costal vein ratio 1:0.55; M_{1+2} vein ratio 1:0.97.

Abdomen: Abdomen ratio of males 1:0.84; length of fourth tergum to fifth tergum ratio of males 1:1.1; fifth tergum ratio of males 1:0.48. Maculation pattern variable but generally as in most species of the *loewi* group. Male terminalia as in diagnosis and in Figures 57–58.



FIGURES 57–58.—*N. carinata:* 57, epandrium, cerci, epandrial process, posterior aspect; 58, internal male genitalia, lateral aspect.

SPECIMENS EXAMINED (138).—DELAWARE: Kent Co., Bombay Hook National Wildlife Refuge (CU). INDIANA: Montgomery Co., Crawfordsville (USNM); Tippecanoe Co., La Fayette (ANSP, USNM). KENTUCKY: Spencer Co., Brashear's Creek-near Salt River (MIU). MARYLAND: Montgomery Co., Plummers Island (USNM). NEW YORK: Genesee Co., Bergen (WNM). NORTH CAROLINA: Macon Co., Highlands (CNC). OHIO: Adams Co., Adams Lake (MIU); Butler Co., Four-Mile Creek-near Oxford (MIU); Wayne Co., 0.8 km S Rittman (KSU). VIRGINIA: Fairfax Co., Potomac River at Scott Run (USNM). Washington, D.C. (ANSP, USNM).

GEOGRAPHIC DISTRIBUTION (Figure 59).—This species is known to occur in the mid Atlantic states between approximately 35° and 45° north latitude and westward into Ohio and Kentucky. Loew's locality label "Mittel St." is being interpreted as the mid Atlantic states area. Collection dates are from 7 June to 18 September.

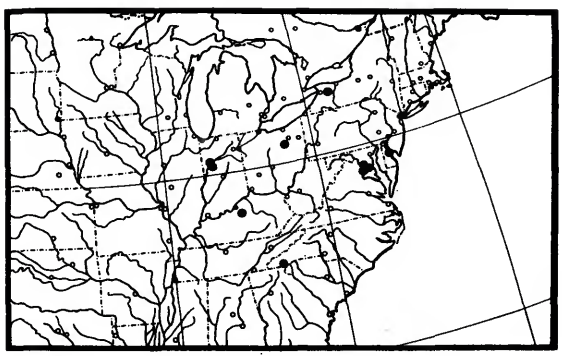


FIGURE 59.—*N. carinata:* distribution map.

REMARKS.—Apparently, Loew described this species from a single female specimen that made later use of the name difficult since most subsequent concepts of this species were based on male specimens. I have interpreted this species by the character states cited in the diagnosis that were associated with reliable characters of the male genitalia of associated specimens.

Deonier, *et al,* 1978 [1979], studied the natural history and life cycle of *N. carinata.* They found specimens of this species in close association with water willow (*Justicia americana* (L.) Vahl), the only known larval host plant. Adults are not common in collections, and over half of the specimens examined were the recovered prey from completely and partially provisioned cells of the Hibiscus Wasp, *Ectemnius (Hypocrabro) paucimaculatus* (Packard) (Krombein, 1964). Adults apparently feed on periphyton, probably grazed from the surface of emergent vegetation. All field-collected larvae had sapropel, or black ooze, in their guts. The guts of a first- and third-instar larva consisted of yellow-green pigment, bacteria, sand particles, and particles of organic detritus. A timetable for the immature stages is as follows:

Eggs: 1–3 days
First-instar larva: 3–5+ days
Second-instar larva: not determined (overwintering)
Third-instar larva: 42–44 days (overwintering)
Puparium: 12–18 days

See Deonier, et al, 1978 [1979], for descriptions and figures of the immature and imago stages.

15. *Notiphila (Notiphila) cressoni,* new name

FIGURES 60–65

Notiphila (Notiphila) bicolor Cresson, 1917:35 [preoccupied, Waltl, 1837:281].
Notiphila (Notiphila) carinata Cresson [in part], 1946:235.

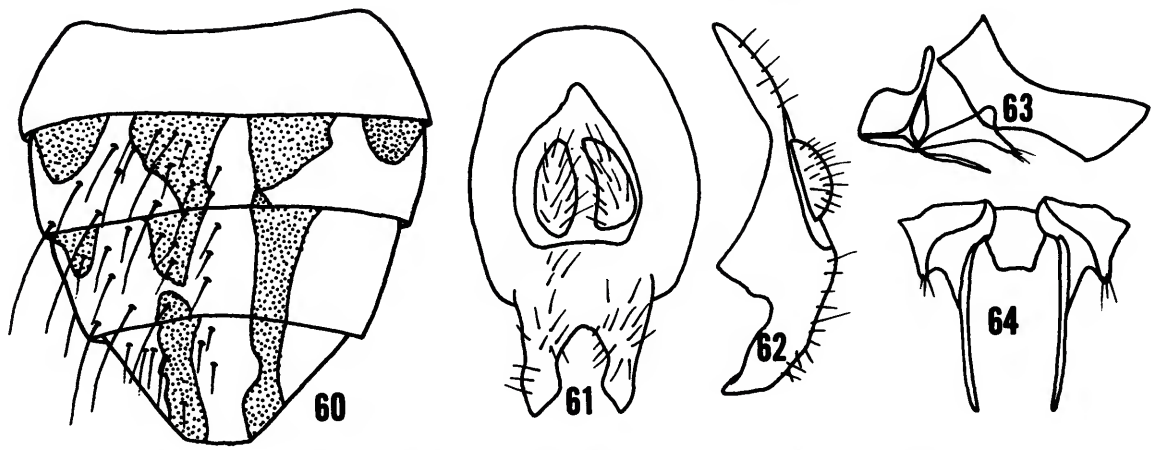
TYPE-MATERIAL.—Holotype male: "Columbia, Mo., May 26 - June 8, '06, C. R. Crosby Coll./Holo-TYPE Notiphila bicolor, E. R. Cresson Jr. (red)/ property of C U, Loaned (pink)/Holotype Cornell No. 4519." The holotype is in the Cornell University insect collection, Ithaca, type number 4519. The type is in relatively good condition although the right third antennal segment is missing and a number of the head bristles have been broken.

DIAGNOSIS.—This species belongs in the *loewi* group as evidenced by the male genitalia, and specimens may be distinguished from all other species of the *loewi* group by the following combination of characters: Specimens small, length 2.38 to 3.23 mm; gena very narrow; ventral margin of epandrium produced into 2 processes, which from a lateral view, curve anteriorly (Figures 61–62); basiphallus long, gently sinuate; aedeagal apodeme very narrowly produced where it attaches to basiphallus but enlarging posteriorly becoming subquadrate (Figures 63–64).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.38 to 3.23 mm, with light brown to brownish gray coloration and some brown markings.

Head: Head ratio 1:0.72; postfrons ratio 1:0.66; frons generally brown, pollinose, lateral margin and median triangular area lighter brown, concolorous. Paravertical bristle weak, only slightly larger than postocellar bristles; at most with 1 very small, proclinate, fronto-orbital seta. First and second antennal segments mostly dark brown but with some paler areas dorsally; third segment pale posteroventrally, otherwise dark; arista with approximately 10 dorsal branches. Face yellowish gray; prefrons ratio 1:0.79; 2–3 facial setae toward ventral margin. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.18. Gena narrow; genal bristle distinct, usually larger than paravertical. Maxillary palpus pale, yellow.

Thorax: Mesonotum slightly darker than pleural areas, immaculate, generally uniformly colored; dorsum of scutellum sometimes lighter than mesonotum in color. Mesopleuron often with undefined



FIGURES 60–64.—*N. cressoni:* 60, abdomen, dorsal aspect; 61, epandrium, cerci, epandrial processes, posterior aspect; 62, same, lateral aspect; 63, internal male genitalia, lateral aspect; 64, hypandrial processes and hypandrial receptacles, ventral aspect.

darker area toward dorsal margin but usually immaculate. Femora mostly gray with some grayish black areas, pale apically; front tibia mostly dark, middle tibia pale, hind tibia pale with preapical, darkened ring. Tarsi pale although front tarsomeres are darker. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.42; costal vein ratio 1:0.50; M_{1+2} vein ratio 1:0.90.

Abdomen (Figure 60): Abdomen ratio of males 1:0.75; length of fourth tergum to fifth tergum ratio of males 1:1.3; fifth tergum ratio of males 1:0.41. Maculation pattern variable, usually with paired darkened areas toward anterior margin on both sides of medial line, more evident on segments 3 and 4. Male genitalia as in Figures 61–64.

SPECIMEN EXAMINED (20).—CANADA: ONTARIO: Simcoe (CNC). UNITED STATES: ARKANSAS: Washington Co., (USNM). IOWA: Allamakee Co., 4.8 km ESE Waterville (ISU); Hamilton Co., Little Wall Lake (ISU). KANSAS: Riley Co., Manhattan (ANSP); Wyandotte Co., 2.4 km S Bonner Springs (ISU). MARYLAND: Baltimore Co., Towson-minebk (ANSP). MISSOURI: Lawrence Co., 6.4 km NE La Russell (ISU, WNM); Saint Louis Co., Creve Coeur (USNM). OHIO: Franklin Co., (OHSU), Columbus (ANSP). PENNSYLVANIA: Philadelphia Co., Philadelphia (ANSP). VIRGINIA: Fairfax Co., Herndon (CSU).

GEOGRAPHIC DISTRIBUTION (Figure 65).—*Notiphila cressoni* has a Midwestern to Mid-Atlantic distribution in North America, and extends northward as far as Ontario, Canada. Collection dates are from 23 May to 22 September.

REMARKS.—The new name, *N. cressoni,* is a genitive patronym honoring E. T. Cresson, Jr., who contributed so much to the study of shore flies. The new name is proposed to replace *N. bicolor* Cresson, which is preoccupied (Waltl, 1837:281).

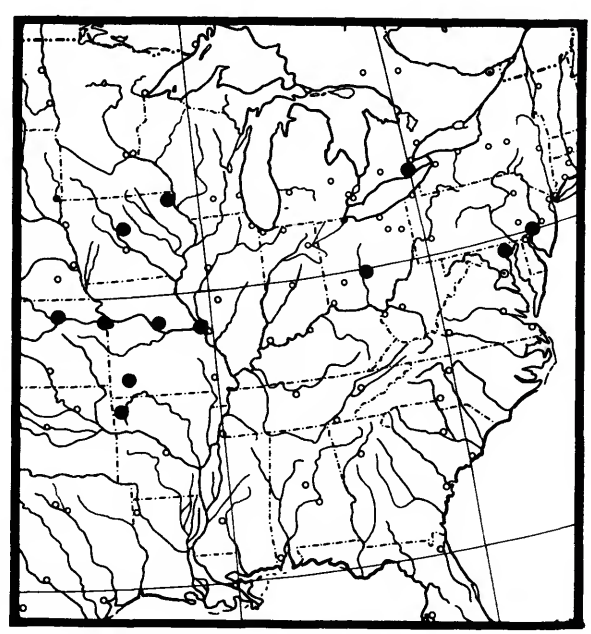


FIGURE 65.—*N. cressoni:* distribution map.

16. *Notiphila (Notiphila) eleomyia,* new species

FIGURES 66–68

DIAGNOSIS—Specimens of *N. eleomyia* are very similar to those of *N. shewelli* but can be differentiated by the following characters: Gena shorter; arms of ventral epandrial process narrower; general conformation of process, although similar to that of *N. shewelli,* is sharply formed; epandrium larger, its lateral margins sinuate (Figure 66–68).

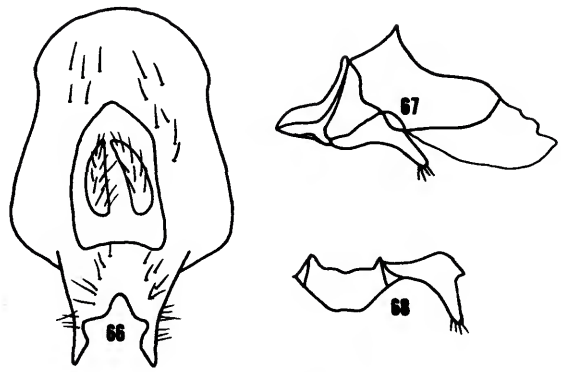
DESCRIPTION.—A medium-sized shore fly with light brown coloration and a few darker brown maculation areas.

Head: Head ratio 1:0.82; postfrons ratio 1:0.71; frons generally brown with some charcoal reflections but with median triangular area and lateral margins lighter in color. Paravertical bristles large, subequal to genal bristles, much larger than postocellar bristles; at most with 1 pair of small, proclinate fronto-orbital setae. First and second antennal segments dark brown, third segment pale orange basally and along posteroventral margin, becoming darker, concolorous with first and second segments along anterodorsal edges; arista with approximately 8 dorsal branches. Face dusted yellow; prefrons ratio 1:0.79; facial setae weak, numbering approximately four to five. Eye ratio 1:0.74; eye-to-cheek ratio 1:0.21. Gena narrow, concolorous with face anteriorly, becoming grayer posteriorly; genal bristle distinct, approximately equal in length to paravertical bristle. Maxillary palpus pale yellow.

Thorax: Mesonotum mostly dusted brown, more or less uniformly colored. Scutellum lighter in color than mesonotum, yellowish gray. Pleural areas generally lighter in color than mesonotum but not distinctly contrasting, lighter areas gradually becoming so. Femora concolorous, dark, gray dusted. Front tibia mostly dark; middle and hind tibiae mostly pale; all tarsi more or less pale, front tarsomeres slightly darker. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.42; costal vein ratio 1:0.41; M_{1+2} vein ratio 1:0.76.

Abdomen: Male terminalia as in diagnosis and in Figures 66–68.

TYPE-MATERIAL.—Holotype male: "Specht Marsh Carrol Co., O. VI. 21 1964/E. J. Allen Collector/ HOLOTYPE Notiphila eleomyia Mathis (red)." The holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73548.



FIGURES 66–68.—*N. eleomyia:* 66, epandrium, cerci, epandrial processes, posterior aspect; 67, internal male genitalia, lateral aspect; 68, hypandrial processes, ventral aspect.

ETYMOLOGY.—The epithet *eleomyia,* of Greek derivation, is a combination of the nouns *eleo* ("marsh") plus *myia* ("fly") referring to the habitat of the species.

SPECIMENS EXAMINED.—This species is known only from the holotype.

GEOGRAPHIC DISTRIBUTION.—The type-locality, Specht Marsh, Carroll Co., Ohio is the only site where this species has been collected.

REMARKS.—Because the male genitalia are distinct from any known *Notiphila* specimens, I feel justified in recognizing it as a new species. Nothing is known of its biology.

17. *Notiphila (Notiphila) floridensis* Cresson

FIGURES 69–72

Notiphila (Notiphila) floridensis Cresson, 1917:46.

TYPE-MATERAL.—Holotype male: "S. Fla. Robertson/♂/Type No. 20723, U.S.N.M./Holo-TYPE Notiphila floridensis, E. T. Cresson Jr." The holotype is in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Cresson also listed a female paratopotype in the original description, which I examined and found to be a male.

DIAGNOSIS.—Specimens of *N. floridensis* closely resemble those of *N. cognata,* and externally, I cannot distinguish between them. However, specimens of *N. floridensis* may be distinguished by the following combination of characters: Dorsal half of mesopleuron often with a darker brown maculation area,

contrasting with gray background; setal fascicle of hind basitarsus black. The genitalia of males of *N. floridensis* are very diagnostic and do not appear to be closely related to any others: Ventral process of epandrium narrow, bifurcating apically to form a U-shaped structure that is setulose laterally midway up both arms; basiphallus uniquely shaped, very narrow, resembling a fish in profile; hypandrial processes not well developed Figures (69–72).

DESCRIPTION.—Medium-sized shore flies, length 3.0 to 3.98 mm; with gray to light brown background coloration and brown markings.

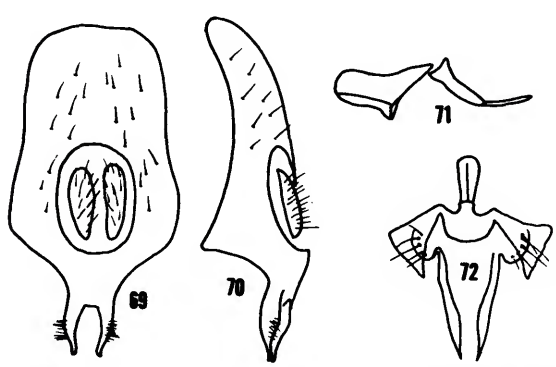
Head: Head ratio 1:0.76; postfrons ratio 1:0.69; frons with anterolateral margins cinereous, median triangular area indicated by being slightly lighter but not contrasting greatly with remainder of frons. Paravertical bristle large, subequal to genal bristle; at most with 1 pair of proclinate, small, frontoorbital setae lateral of large reclinate bristle. First and second antennal segments dark, dark brown to black; third segment with extensive pale areas toward posteroventral corner, otherwise dark brown; arista with approximately 8 dorsal branches. Face cinereous to niveous; facial setae well developed, restricted to lower half of face, numbering 3–4; prefrons ratio 1:0.79. Eye ratio 1:0.89; eye-to-cheek ratio 1:0.35. Gena very wide; genal bristle distinct and slightly larger than largest facial bristles; gena concolorous with face. Maxillary palpus pale, yellowish orange.

Thorax: Mesonotum light brown, gray anteriorly and on extreme lateral margins; scutellum mostly gray. Mesopleuron with brown maculation area toward dorsal margin, indistinct and often covering most of the dorsal half. Pleural areas mostly gray but with some brownish coloration. Femora dark, gray, pollinose over extensive areas; tibiae and tarsi pale, yellowish orange but with some darker coloration. Setal fascicle of hind basitarsus dark, black. Wing ratio 1:0.44; costal vein ratio 1:0.62; M_{1+2} vein ratio 1:0.83

Abdomen: Abdomen ratio of males 1:0.89; length of fourth tergum to fifth tergum ratio of males 1:0.89; fifth tergum ratio of males 1:0.40. Abdomen mostly gray but usually with geminate brown spots on either side of midline and toward anterior margin on third and fourth terga, some females with 4 spots per tergum. Female terminalia consisting of segments six and eight well sclerotized and the seventh mostly membranous. Male terminalia as in diagnosis and in Figures 69–72.

SPECIMENS EXAMINED (38).—FLORIDA: Citrus Co., Inverness (ANSP); Putnam Co., Drayton Island (ANSP). GEORGIA: Charlton Co., Okefenokee Swamp (USNM). ILLINOIS: Macoupin Co., Carlinville (INHS, WNM).

GEOGRAPHIC DISTRIBUTION.—Apparently this species occurs mainly in southeastern United States, although most specimens were collected just north of St. Louis in Carlinville, Illinois. As indicated above, very few collection records are known. Collection dates are from 8 August to 5 September.



FIGURES 69–72.—*N. floridensis:* 69, epandrium, cerci, epandrial processes, posterior aspect; 70, same, lateral aspect; 71, internal male genitalia, lateral aspect; 72, hypandrial processes and hypandrial receptacles, ventral aspect.

18. *Notiphila (Notiphila) latigena*, new species

FIGURE 73–75

DIAGNOSIS.—*N. latigena* belongs to the *loewi* group and is closely allied to *N. cressoni* and *N. loewi*. The general facies of the head are also similar to members of *N. floridensis*. *N. latigena* specimens differ from those of all similar congeners by the following combination of characters: gena high, resulting in large eye-to-cheek ratio; total body length approximately 3.50 mm; shape of the ventral epandrial process distinctive; arms of ventral epandrial process short, arising from a narrow base, diverging from each other to form a wide, V-shaped process; internal structures of genitalia very similar to those of *N. loewi* and *N. cressoni* males indicating a close relationship with both Figures (73–75).

DESCRIPTION.—A medium-sized shore fly, length of holotype 3.43 mm; with light dusted brown to

gray coloration and a few very faint brown markings.

Head: Head ratio 1:0.78; postfrons ratio 1:0.69; frons mostly light brown to brown with distinguishable median triangular area that is lighter in color, anterior angle of median triangle with brown spot concolorous with lateral margins of mesofrons, extreme lateral margins of frons considerably lighter than remainder of frons, concolorous with face. At most with 1 proclinate, small, frontoorbital seta. First and second antennal segments dark brown, third segment pale, yellowish orange basally but concolorous with first and second segments along anterodorsal margin; arista with 7–8 dorsal branches. Face grayish yellow, pollinose; prefrons ratio 1:0.80; facial setae weak, numbering 4–5 and restricted to lower half of face. Eye-to-cheek ratio 1:0.29; eye ratio 1:0.83. Gena high, anterior portion concolorous with face, becoming grayer posteriorly; genal bristle very distinct. Maxillary palpus pale, yellow.

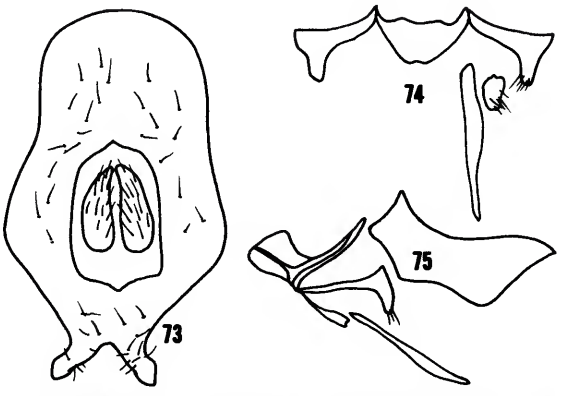
Thorax: mesonotum light brown, appearing dusted, mostly uniformly colored but with some darker areas. Scutellar disc lighter in color than mesonotum, grayer. Pleural areas distinctly lighter in color than mesonotum, tending to become lighter ventrally, gray, mesopleuron with faint brown maculation areas. Femora gray, dusted, apically pale; tibiae and tarsi all pale. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.41; costal vein ratio 1:0.43; M_{1+2} vein ratio 1:0.82.

Abdomen: Abdomen ratio of males 1:0.66; length of fourth tergum to fifth tergum of males 1:1.2; fifth tergum ratio of males 1:0.57. Abdomen mostly unicolorous, but with a few darker maculation areas, mostly faint bigeminate toward anterior edge. Male terminalia as in diagnosis and in Figures 73–75.

TYPE-MATERIAL.—Holotype male: "Florida Highlands Co., Archbold Biological Station, 15 March 1964, S. W. Frost/HOLOTYPE Notiphila latigena Mathis (red)." Other paratypes as follows: 1 ♂, Florida, Silver Springs, 2 April 1932, A. L. Melander (ANSP). The holotype will be deposited with the Frost Entomological Museum, Pennsylvania State University.

ETYMOLOGY.—The epithet *latigena,* of Latin derivation, is a combination of the adjective *latus,* ("wide") plus the noun *gena* ("cheek") referring to the high gena.

GEOGRAPHIC DISTRIBUTION.—This species has been collected only in Florida, although I suspect that it will eventually be found to occur more widely in the Southeast.



FIGURES 73–75.—*N. latigena:* 73, epandrium, cerci, epandrial processes, posterior aspect; 74, hypandrial process and hypandrial receptacle, ventral aspect of one side; 75, internal male genitalia, lateral aspect.

19. *Notiphila (Notiphila) loewi* Cresson

FIGURES 76–79

Notiphila (Notiphila) loewi Cresson, 1917:44.

TYPE-MATERIAL.—Holotype male: "Sandusky, Cedar Pt, O./16 July 1902." Cresson's original description also lists one male and nine female paratopotypes. The holotype is in the Ohio State University.

DIAGNOSIS.—*Notiphila loewi* belongs to the *loewi* group and is very similar to most of the other included species. However, specimens of this species may be distinguished from those of related congeners by the following combination of characters: Specimens generally larger than those of *N. cressoni* and *N. carinata* but approximately the same size as *N. shewelli;* eye-to-cheek ratio significantly less than that of *N. shewelli;* mesopleuron bearing only a faint, indefinite indication of darkened spot; usually a median, mesonotal stripe lacking or very poorly developed; maculation pattern on abdomen variable but usually more extensive than in specimens of *N. poliosoma.* Male genitalia of *N. loewi* specimens distinctive, the most reliable characters for distinguishing this species: Shape of ventral epandrial process especially diagnostic;

aedeagal apodeme, basiphallus, and hypandrial process useful (Figures 76–78).

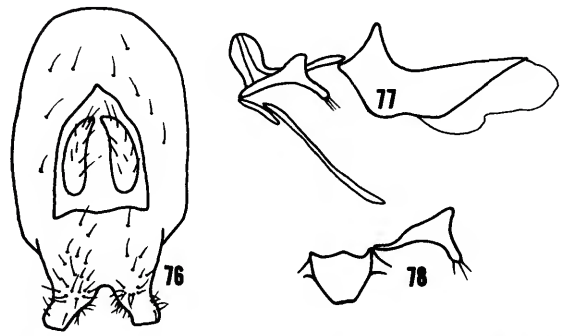
DESCRIPTION.—Moderately small to moderately large shore flies, length 2.98 to 4.07 mm; with light brownish gray to brown coloration and a few darker brown markings.

Head: Head ratio 1:0.72; postfrons ratio 1:0.68; frons mostly light brown, pollinose, often with some charcoal or greenish coloration; median triangular area and lateral margins usually concolorous and lighter than remainder of frons. Paravertical bristle large, usually larger than genal bristle. At most with 1 proclinate, fronto-orbital seta. First and second antennal segments dark, blackish brown; third segment pale, orange, especially toward posteroventral margin and base, otherwise darkened; arista with 7–9 dorsal branches. Face light yellow to grayish yellow; prefrons ratio 1:0.82; facial setae numbering 3–4 on ventral portion only, larger than postocellar setae. Eye ratio 1:0.81; eye-to-cheek ratio 1:0.21. Gena moderately narrow and generally concolorous with face although becoming grayer posteriorly; genal bristle strong but usually smaller than paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Mesonotum light brown, dusted, slightly darker than pleura, usually without median stripe or with only a faint indication. Mesopleuron with indefinite, faint darkened area toward dorsal margin. Femora mostly gray, usually darkened dorsally; front tibia and tarsomeres concolorous, superficially darkened but apically pale; middle and hind tibiae mostly pale, sometimes with darkened preapical ring; middle and hind tarsi pale. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.47; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:0.87.

Abdomen: Background color often somewhat grayer than thorax. Abdomen ratio of males 1:0.71; length of fourth tergum to fifth tergum ratio of males 1:1.1; fifth tergum ratio of males 1:0.67. Maculation pattern variable, best developed on segments three and four, usually with 2 oblong spots on either side of median line, sometimes with darkened area connecting spots anteriorly. Male terminalia as in diagnosis and in Figures 76–78.

SPECIMENS EXAMINED (124).—CANADA: BRITISH COLUMBIA: Agassiz (CNC); Vancouver Island-Elk Lake (ANSP, USNM). ONTARIO: Dundas Marsh (CNC); Grand Bend (CNC); Kingston (USNM); London (USNM); Lyndhurst (CNC); Pembroke (ANSP). QUEBEC: Lac Bernard (CNC); Norway Bay (CNC); Saint Chrysostome (CNC). UNITED STATES: FLORIDA: Alachua Co., Gainesville (USNM). ILLINOIS: Lake Co., Pistakee Bay (ANSP, USNM); Mason Co., Havana (ANSP, INHS); McHenry Co., McHenry (USNM). INDIANA: Tippecoanoe Co., La Fayette (USNM). IOWA: Dickinson Co., Milford Woods-Okoboji Twp. (ISU); Monona Co., Lewis and Clark State Park (ISU). MARYLAND: Cecil Co., Egypt Road (CU). MICHIGAN: Arenac Co. (USNM); Houghton Co. (USNM); Midland Co. (USNM); Monroe Co., Monroe (ANSP, USNM). MINNESOTA: Clearwater Co., Itasca State Park (ISU), Lake Itasca, W side across from Biological Station (ISU); Ramsey Co., Saint Paul-Bussey's Pond (UMN). MONTANA: Lake Co., 5.7 km E Polson (KSU). NEW YORK: Dutchess Co., Stanfordville (ANSP); Warren Co., Adirondack-Connery Pond (ANSP, USNM). OHIO: Carroll Co., Specht Marsh (KSU); Erie Co., Sandusky-Cedar Point (ANSP, KU, OHSU); Portage Co., 1.6 km E Kent (KSU). PENNSYLVANIA: Luzerne Co., Ashley (USNM). SOUTH DAKOTA: Custer Co., 12.9 km N Pringle-Flynn Creek (CNC). TEXAS: Val Verde Co., Del Rio-Devil's River (CNC).



FIGURES 76–78.—*N. loewi:* 76, epandrium, cerci, epandrial process, posterior aspect; 77, internal male genitalia, lateral aspect; 78, hypandrial process, ventral aspect.

GEOGRAPHIC DISTRIBUTION (Figure 79).—*Notiphila loewi* is widespread in eastern North America, extending westward through South Dakota into Montana and British Columbia. In the East, no specimens from the Gulf Coast between Texas and Florida were examined. Collection dates are from 27 April to 9 September.

REMARKS.—The following comments clarify the name I have used for this species. Loew (1862) described a new North American species as *N. unicolor.* Two years later, Walker (1864) described a second Notiphiline species with the same name; that name thus became a primary homonym of *N. unicolor* Loew. Cresson (1917) erred in dating Walker's description as 1860 rather than 1864 and accordingly, proposed a new name for Loew's species. Cresson's "new name" was *N. loewi* and *N. unicolor* Loew was listed as a questionable, preoccupied syn-

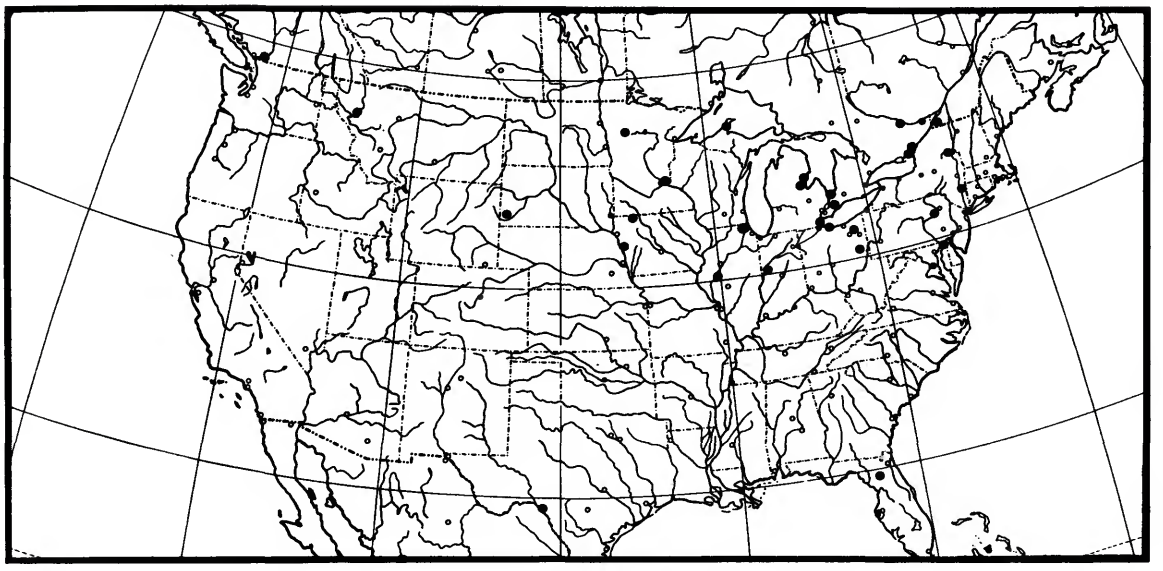


FIGURE 79.—*N. loewi:* distribution map.

onym. Although *N. loewi* was given as the replacement name, Cresson (1917:45) also designated a new holotype specimen and mentioned in his discussion that ". . . being uncertain as to the correct identification of *unicolor,* I am supplying a *new species* (italics mine) for my series."

Notiphila unicolor Loew was and has subsequently been considered a junior, preoccupied synonym of *N. loewi* (Wirth, 1965). After studying the type of *N. unicolor* Loew and comparing it with that of *N. loewi,* I have concluded that *N. unicolor* Loew is a separate species. Dissections of male genitalia were made and compared. By correcting Cresson's error in dating, *N. unicolor* Loew is not preoccupied and stands as the valid name for that species. The problem, however, is what is the type of *N. loewi*?

The problem was referred to Dr. Curtis W. Sabrosky, president of the International Commission of Zoological Nomenclature, for his opinion. Dr. Sabrosky (pers. comm.) suggested that *N. loewi* Cresson should be treated as a new species with its own type as designated by Cresson. This was suggested in view of the overall substance of Cresson's article in which he listed *N. unicolor* Loew only questionably as a synonym, designated a new holotype, and treated *N. loewi* as a "new species" in his discussion.

Berg (1950) noted that mature larvae and puparia of *N. loewi* were found attached to the roots of *Potamogeton alpinus* Balbis and *P. richardsonii* (Bennett) Rydb. The mud substrate has a high content of decaying, organic matter and was nearly devoid of free oxygen. Berg successfully reared puparia to adults by carefully removing them from root tissue and placing them in moist, sphagnum moss with the respiratory spines projecting into the air. Puparia left attached to floating roots became waterlogged and sank. Berg did not observe eggs or young larvae of this species.

20. *Notiphila (Notiphila) oriens,* new species

FIGURES 80–82

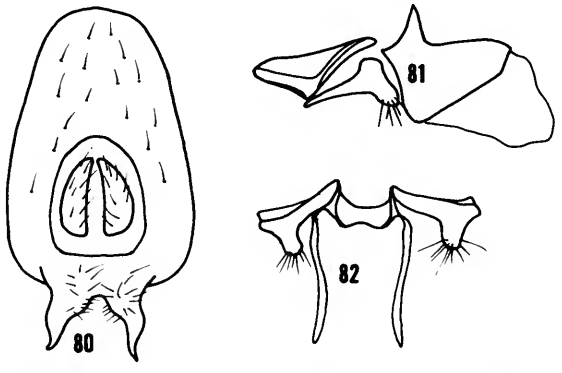
DIAGNOSIS.—Specimens of *N. oriens* appear to be very similar to those of *N. erythrocera,* but they may be distinguished by the following combination of characters: Facial setae weak, hairlike; second and third antennal segments mostly dark, although with some pale areas; arms of ventral process of epandrium shorter than those of *N. erythrocera* males; arms also thicker and sinuate (Figures 80–82).

DESCRIPTION.—Moderately small shore flies, length approximately 2.88 mm; with light brown to grayish brown coloration and some darker brown markings.

Head: Head ratio 1:0.75; postfrons ratio 1:0.67; frons mostly brown but with some darker, charcoal tinged areas, median triangular areas and lateral margins usually lighter in color. Paravertical bristle approximately equal to genal bristle, larger than postocellars; with at most 1 developed proclinate, fronto-orbital seta. First and second antennal segments mostly dark brown, second segment sometimes with extensive pale areas; third segment mostly pale although anterodorsal margin is often darkened; arista with approximately 9 dorsal branches. Face unicolorous, light yellow, appearing dusted, facial setae small, hairlike, numbering 3–4; prefrons ratio 1:0.67. Eye ratio 1:0.80; eye-to-cheek ratio 1:0.18. Gena narrow, mostly concolorous with face, becoming grayer posteriorly; genal bristle subequal to paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Mesonotum mostly brown to dusted, grayish brown, darker than pleural areas, generally immaculate but sometimes with some faint darkened areas. Mesopleuron usually with a small, dark brown maculation spot toward dorsal edge. Femora dark, brownish black to black, with some dusted gray areas; tibiae generally concolorous with femora, apically pale; tarsi pale although fore tarsomeres somewhat darkened. Setal fascicle of hind basitarsus dark, black. Wing ratio 1:0.37; costal vein ratio 1:0.54; M_{1+2} vein ratio 1:0.84.

Abdomen: Abdomen ratio of males 1:0.82; length of fourth tergum to fifth tergum ratio of males 1:1.2; fifth tergum ratio of males 1:0.49. Maculation pattern as in most species of *loewi* group. Male genitalia as in diagnosis and in Figures 80–82.



FIGURES 80–82.—*N. oriens:* 80, epandrium, cerci, epandrial process, posterior aspect; 81, internal male genitalia, lateral aspect; 82, hypandrial processes and hypandrial receptacles, ventral aspect.

TYPE-MATERIAL.—Holotype male: "USA, Georgia: Liberty Co., St. Catherines Island, April 24–28, 1972, Thompson and Picchi/HOLOTYPE Notiphila oriens Mathis (red)." Other paratypes as follows: 1 ♂, Manahawkin, 5 September 1910, NJ (New Jersey), 763 (ANSP); 1 ♂, DC (Washington, D.C.), 19 August 1899 (OHSU). The male holotype will be deposited in the insect collection of the American Museum of Natural History.

ETYMOLOGY.—The epithet *oriens* is a Latin noun ("east") in allusion to the distribution of this species along the east coast of North America. It is a noun in apposition to the generic name.

GEOGRAPHIC DISTRIBUTION.—*Notiphila oriens* is known only from the southeastern coast of North America, from New Jersey to Georgia.

21. *Notiphila (Notiphila) unicolor* Loew

FIGURES 83–85

Notiphila unicolor Loew, 1862:137.

TYPE-MATERIAL.—Holotype male: "Mittel St. (green)/Loew Coll./unicolor ♂/Type 11128 (red)." The holotype is in the Museum of Comparative Zoology, Harvard University, type number 11128. While dissecting the abdomen, the hind legs and part of the right side of the thorax also came off; these structures have been placed in a microvial with the abdomen.

DIAGNOSIS.—Specimens of *N. unicolor* are superficially very similar to those of *N. cressoni, N. loewi,* and *N. shewelli.* These relationships are borne out by the close resemblance in male genitalia, especially the shapes of the internal structures. The ventral process of the epandrium of *N. unicolor* males, however, is distinctive and will serve to distinguish it from related species (Figures 83–85).

DESCRIPTION.—A moderately small shore fly, length 2.91 mm; with subdued light brownish gray coloration and a few brown markings.

Head: Head ratio 1:0.75; postfrons ratio 1:0.70; frons tan with median triangular area and lateral margins concolorous, lighter, yellowish gray. Paravertical bristle 2 to 3 times length of postocellars; one proclinate, fronto-orbital seta. First and second antennal segments dark brown although second

segment with some pale coloration along dorsal surface; arista with 9 dorsal branches. Face mostly gray with some light yellowish tinges; facial setae weak, 2–3 on lower portion. Eye ratio 1:0.79; eye-to-cheek ratio 1:0.24. Gena concolorous, light yellowish gray; genal bristle subequal to paravertical bristle. Maxillary palpus pale, yellow.

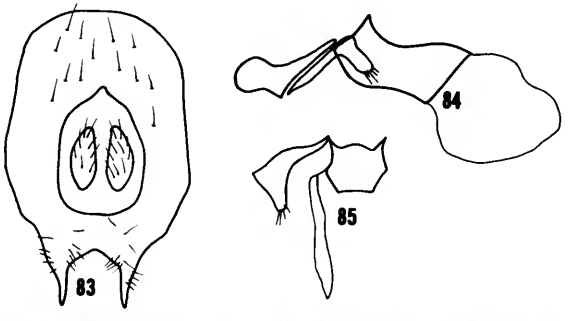
Thorax: Mesonotum only slightly darker than pleural areas, both generally immaculate, gray to brownish gray. Femora gray; all tibiae and tarsi pale yellow. Setal fascicle of hind basitarsus dark, brown to black. Wing ratio 1:0.39; costal vein ratio 1:0.40; M_{1+2} vein 1:0.95.

Abdomen: Generally gray with some light greenish blue coloration along anterior margins of segments. Dorsum of third and fourth terga with two brown spots near the middle, maculation spots much better developed on fourth segment. Male terminalia as in Figures 83–85.

SPECIMENS EXAMINED.—*Notiphila unicolor* is known only from the male holotype.

GEOGRAPHIC DISTRIBUTION.—The type-locality, "Mittel St." is the only site where this species has been collected.

REMARKS.—Cresson (1917) questionably listed *N. unicolor* as a synonym of *N. loewi* Cresson and as a preoccupied name, earlier usage by Walker having priority. The date Cresson cited for Walker's name was 1860, which would make Loew's usage of the same name in 1862 invalid as a homonym. Walker, however, did not publish *N. unicolor* until 1864, subsequent to Loew's description, thus making Walker's usage of the name invalid and requiring a new name. Further discussion of the nomenclature of this species and of *N. loewi* is found in the "Remarks" under *N. loewi*.



FIGURES 83–85.—*N. unicolor:* 83 epandrium, cerci, and epandrial processes, posterior aspect; 84 internal male genitalia, lateral aspect; 85, hypandrial process and hypandrial receptacle, ventral aspect of one side.

22. *Notiphila (Notiphila) pauroura*, new species

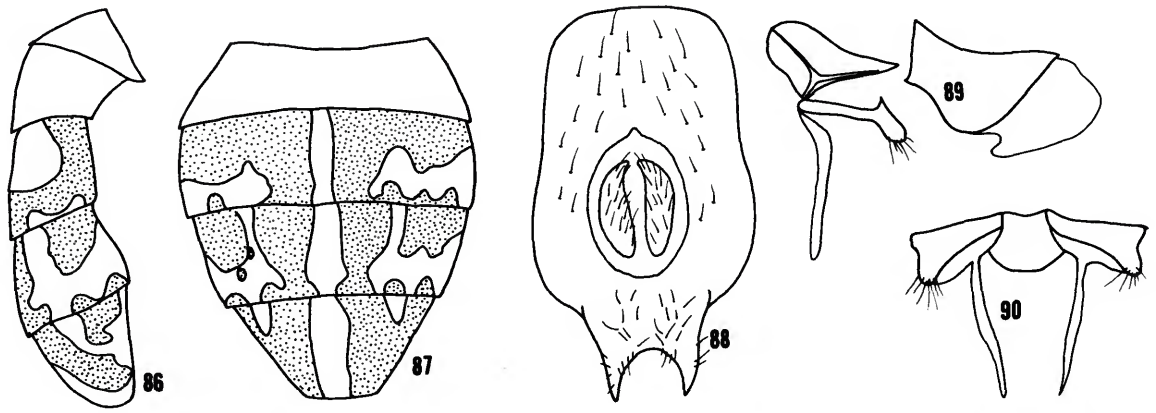
FIGURES 86–91

DIAGNOSIS.—Specimens of *N. pauroura* appear to be very similar to those of *N. solita*, but they may be distinguished from the latter by the following combination of characters: Median stripe on mesonotum as strongly developed throughout its length as lateral vittate markings; posteriorly, the stripe bifurcates; other vittate markings on both mesonotum and mesopleuron better developed and more extensive; dorsum of scutellum immaculate, appearing to be slightly lighter in color than mesonotum; lateral margins of scutellum darkened like *N. solita*; abdominal dimensions of males (Figures 86–87) more similar to most *Notiphila*, sensu stricto, species; fifth abdominal segment much wider than long but maculation pattern of abdominal segments resembles that of *N. solita* members although with considerable variation. The male terminalia of *N. pauroura* specimens differ markedly from that of *N. solita*. This is especially evident by comparing the shapes of the epandrium and basiphallus: Epandrium of *N. pauroura* more rectangular; basiphallus expanding apically (Figures 88–90).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.80 to 3.55 mm; with yellowish brown to tannish gray coloration and brown markings.

Head: Head ratio 1:0.75; postfrons ratio 1:0.66; frons generally unicolorous, brown, pollinose, except for extreme lateral margins and part of the median triangular area, especially toward vertex, which is much lighter, more gray. Paravertical bristle strong, much larger than postocellar setae; at most with 1 proclinate, fronto-orbital seta. First and second antennal segments dark brown; third segment often mostly pale but usually darkened along anterior and dorsal surfaces; arista with 11–13 dorsal branches. Face yellow; prefrons ratio 1:0.70; setae of face consisting of 3–4 small hairs. Eye ratio 1:0.75; eye-to-cheek ratio 1:0.14. Gena very narrow; genal bristle subequal to paravertical bristle. Maxillary palpus yellow.

Thorax: Mesonotum darker than pleural areas, vittate; median stripe strong, bifurcating poste-



FIGURES 86–90.—*N. pauroura:* 86, abdomen, lateral aspect; 87, same, dorsal aspect; 88, epandrium, cerci, and epandrial processes, posterior aspect; 89, internal male genitalia, lateral aspect; 90, hypandrial processes and hypandrial receptacle, ventral aspect.

riorly; vittate markings also at level of posterior intra-alar bristle and at presutural bristle level. Lateral margin of scutellum brownish black as viewed from posterior angle. Mesopleuron with 2 vittate markings, 1 near dorsal edge, other along ventral edge. Femora grayish black, pale apically; front tibia generally concolorous with femora; other tibiae pale except for dark preapical ring on hind tibiae; all tarsi light, yellow. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.47; costal vein ratio 1:0.46; M_{1+2} vein ratio 1:0.85.

Abdomen (Figures 86–87): Abdomen ratio of males 1:0.82; length of fourth tergum to fifth tergum ratio of males 1:1; fifth tergum ratio of males 1:0.49. Maculation markings on abdomen as in *N. solita*. Figures 14 and 16. Male terminalia as in diagnosis and in Figures 88–90.

TYPE-MATERIAL.—Holotype male: "Bronx N.Y. VI-1940-23/Collector S. C. Harriot/HOLOTYPE Notiphila pauroura Mathis (red)." Allotype, and four female paratypes with same label data as the type. Other paratypes as follows: 1♂, Sta. Study Insects, Tuxedo, Orange Co., N.Y., Lily VI-29-1928, Collector, C. H. Curran (AMNH); 1♂, Snake Hill, New Jersey (AMNH); 1♂, Fishers, Ontario, Co., N.Y., 6-VIII '33 (USNM); 1♂, Ottawa, Ont., 4-VII-1956, J. R. Vockeroth (CNC); 1♂, Archbold Biol. Station, Highlands Co. Fla., S. W. Frost, 4-7-64 (USNM); 2♂, 1♀, Gainesville, Fla., R. P. Esser, coll. 29 IV 63, coll. at light (FSCA, USNM); 2♀, Highlands Hammock, St. Pk., Highlands Co., Fla., H. V. Weems, Jr., coll. 26 III 63 (FSCA, USNM). The holotype will be deposited in the American Museum of Natural History.

ETYMOLOGY.—The epithet *pauroura,* of Greek derivation, is a combination of *pauros* "little") plus *oura* ("tail") in allusion to the small fifth abdominal segment.

OTHER SPECIMENS EXAMINED (18).—FLORIDA: Lake Co., 3.2 km S Tavares, St. 448 (FSCA); Osceola Co., Kissimmee (ANSP); Polk Co., Lakeland (ANSP). MISSOURI: Boone Co., Columbia (CU). NEW YORK: Tompkins Co., Dryden-Dryden Lake outlet (CU).

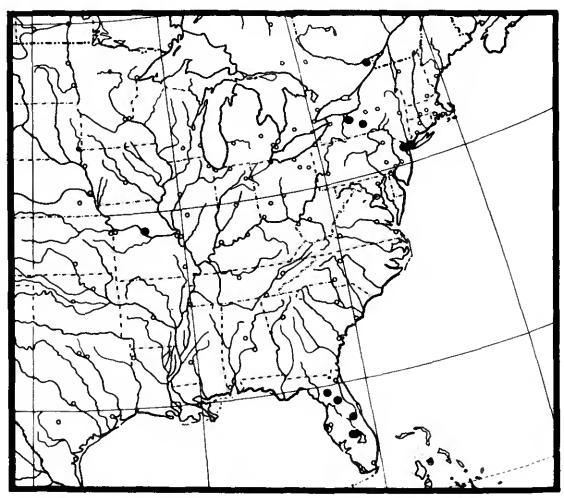


FIGURE 91.—*N. pauroura:* distribution map.

GEOGRAPHIC DISTRIBUTION (Figure 91.)—*Notiphilia pauroura* occurs sympatrically with *N. solita* throughout most of eastern North America. Collection dates are from 1 February to 15 August.

23. *Notiphila (Notiphila) poliosoma,* new species

FIGURES 92–94

DIAGNOSIS.—Specimens of *N. poliosoma* are among the most distinctive members of the *loewi* group. Externally, members of this species are generally characterized by extensive gray coloration, by the lacteous, pollinose postfrons, and by the almost entirely pale third antennal segment. The male genitalia are also diagnostic: Ventral process of the epandrium proportionately very long in relation to rest of the epandrium; shape of arms distinctive (Figures 92–94).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.96 to 3.76 mm; with gray to slightly brownish gray coloration and very few light brown markings.

Head: Head ratio 1:0.75; postfrons ratio 1:0.70; frons mostly lacteous in coloration, median triangular area and lateral margins slightly lighter. Paravertical bristle approximately equal to genal bristle, larger than postocellars; at most with 1 frontoorbital seta. First and second antennal segments mostly dark brown, anterodorsal area of second segment with some pale coloration; third antennal segment mostly pale, yellow, sometimes with some dark tinges along anterodorsal margin; arista with approximately 8 dorsal branches. Pale unicolorous, light yellow; prefrons ratio 1:0.79. Eye ratio 1:0.84; eye-to-cheek ratio 1:0.24. Gena moderately narrow, mostly concolorous with face anteriorly becoming gray posteriorly; genal bristle subequal to paravertical bristle. Maxillary palpus pale, yellow.

Thorax: Mesonotum mostly gray but with some light brown dusted areas, especially posteriorly; scutellum usually lighter gray in coloration than mesonotum. Pleural areas mostly gray, lighter in color than mesonotum; mesopleuron often with a faint light brown maculation area toward dorsal margin. Femora almost entirely gray but with some darker, charcoal areas, apically pale; tibiae and tarsi entirely pale. Setal fascicle of hind basitarsus dark brown to black. Wing ratio 1:0.43; costal vein ratio 1:0.45; M_{1+2} vein ratio 1:0.81.

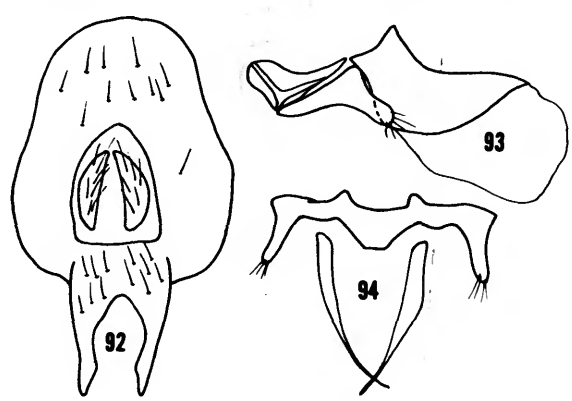
Abdomen: Abdomen ratio of males 1:0.67; length of fourth tergum to fifth tergum of males 1:1; fifth tergum ratio of males 1:0.53. Coloration mostly gray, pollinose, third and fourth terga with two small geminate, light brown maculation spots on anterior margin. Male genitalia as in diagnosis and in Figures 92–94.

TYPE-MATERIAL.—Holotype male: "Franklin Co., 16 June 1936, Ohio/A. Peterson, collector/HOLOTYPE Notiphila poliosoma Mathis (red)." Allotype female and three paratypes (1♂, 2♀): "Carlinville, Illinois, Charles Robertson Collection (collection numbers 6396 to 6399, INHS)." Other paratypes as follows: 2♂, 1♀, Kansas, Linn Co., Marais des Cygnes Wildlife Refuge area, 5 September 1961, D. L. Deonier, on floating leaf of *Potomogeton* sp. (ISU, WNM); 1♀, Kansas, Douglas Co., Kansas University Natural History Reserve, 7 June 1963, D. L. Deonier (ISU); 5♂, 2♀, Wisconsin, La Crosse Co., 2–3, August 1975, D. F. Sefton (WNM). The holotype will be deposited with the Ohio State University insect collection, Columbus.

ETYMOLOGY.—The epithet *poliosoma,* of Greek derivation, is a combination of *polios* ("gray") plus *soma* ("body") in reference to the gray general body coloration.

GEOGRAPHIC DISTRIBUTION.—This species occurs in midwestern United States. Collection dates are from 7 June to 5 September.

REMARKS.—One of the paratypes from Kansas bore a label reading "on floating leaf of *Potomogeton sp.*" This could be the primary plant to



FIGURES 92–94.—*N. poliosoma:* 92, epandrium, cerci, and epandrial processes, posterior aspect; 93, internal male genitalia, lateral aspect; 94, hypandrial processes and hypandrial receptacles, ventral aspect.

which this species attaches during the larval and pupal stages.

24. *Notiphila (Notiphila) shewelli*, new species

FIGURES 95–98

DIAGNOSIS.—*N. shewelli* belongs to the *loewi* group and specimens are very similar to those of *N. loewi*. However, they may be distinguished from *loewi* and related species by the following combination of characters: Gena very high, eye-to-cheek ratio approximately 1:0.27; mesopleuron with an undefined maculation area toward dorsal margin or it is immaculate; maculation pattern on abdomen variable but generally reduced, consisting of light brown geminate spots, pattern more pronounced on segments 3 and 4. Male genitalia are distinctive, particularly the ventral extension of the epandrium as shown in Figure 95. From a lateral view, the ventral extension projects straight outward without curving dorsally. The ventral margin of the basiphallus also has a very prominent enlargement near the middle (Figures 95–97).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.0 to 4.2 mm, with brown to gray-brown coloration and some darker brown markings.

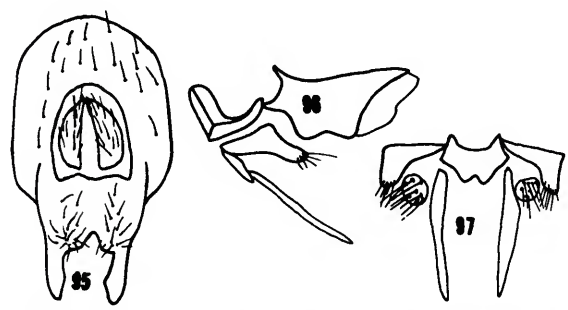
Head: Head ratio 1:0.75; postfrons ratio 1:0.67; frons with lateral margins and median triangular area concolorous, lighter than remainder of frons, which is generally light brown, pollinose; paravertical bristle larger than postocellar setae; at most with 1 proclinate, fronto-orbital seta. Antennal segments mostly dark brown except for posteroventral surface of third segment, which is orange to brownish orange; arista with approximately 8 dorsal branches. Face wide, prefrons ratio 1:0.84, light yellow in color; facial setae numbering 2–3, subequal to postocellar bristles. Eye ratio 1:0.82; eye-to-cheek ratio 1:0.27. Gena wide; genal bristle equal or slightly smaller than paravertical bristle. Maxillary palpus pale, yellow.

Thorax: More or less unicolorous although mesonotum is often slightly darker. Mesonotum with very weak medium stripe, some specimens immaculate; mesopleuron usually with maculation spot toward dorsal edge that is undefined, blending with surrounding color, often immaculate. Femora mostly gray, pale apically; tibiae usually concolorous with femora except hind tibia, which has darkened dorsal surface at middle; front tarsomeres with blackish brown tinges, middle and hind tarsi mostly pale, yellowish. Setal fascicle of hind basitarsus dark. Wing ratio 1:0.45; costal vein ratio 1:0.45; M_{1+2} vein ratio 1:0.83.

Abdomen: Abdomen ratio of males 1:0.66; length of fourth tergum to fifth tergum ratio of males 1:1.1; fifth tergum ratio of males 1:0.54. Abdomen generally concolorous with thorax; maculation pattern on dorsum variable, from two very reduced geminate spots on segments three and four to four spots on 3 and 4 plus some markings on segments 2 to 5. Male terminalia as in Figures 95–97.

TYPE-MATERIAL.—Holotype male: "Ottawa Ont. 2-VII-1947 G. E. Shewell/Rockcliffe/Associated with Nymphae advena/HOLOTYPE Notiphila shewelli Mathis (red)." Allotype female and 47 paratypes (27♂, 20♀) with the same label data as the type (CNC, USNM, WNM). The holotype will be deposited with the Canadian National Collection, Ottawa, type number 13775.

OTHER SPECIMENS EXAMINED (76).—CANADA: ONTARIO: Algonquin Park (ANSP, CNC); Marmora (CNC); Ottawa (CNC); Pembroke (USNM); Perth Road (CNC); Point Pelee (CNC). QUEBEC: Abbotsford (CNC); Lac Mondor-Ste. Flore (CNC). UNITED STATES: CONNECTICUT: Hartford Co., Avon-Avon Old Farms (FSCA). MAINE: Hancock Co., Mount Desert Island (ANSP, WSU). MASSACHUSETTS: Nantucket Co., Nantucket (ANSP). MICHIGAN: Cheboygan Co., Douglas Lake (USNM). MINNESOTA: Lake Co., Basswood Lake (UMN); Roseau Co., Warroad (UMN). MONTANA: Lake Co., 1.6 km S Swan Lake (WMN). NEW HAMPSHIRE: Graffon Co., Franconia Notch (ANSP). NEW YORK: Dutchess Co., Stanfordville (CU); Franklin Co., Franklintown (ANSP, NYSM); Orange Co., Tuxedo-Lily (USNM). Tuxedo-Station Study Insect (AMNH, FSCA). WASHINGTON: San Juan Co., Orcas Island, Mount Constitution (ANSP).



FIGURES 95–97.—*N. shewelli:* 95, epandrium, cerci, and epandrial processes, posterior aspect; 96, internal male genitalia, lateral aspect, 97, hypandrial processes and hypandrial receptacles, central aspect.

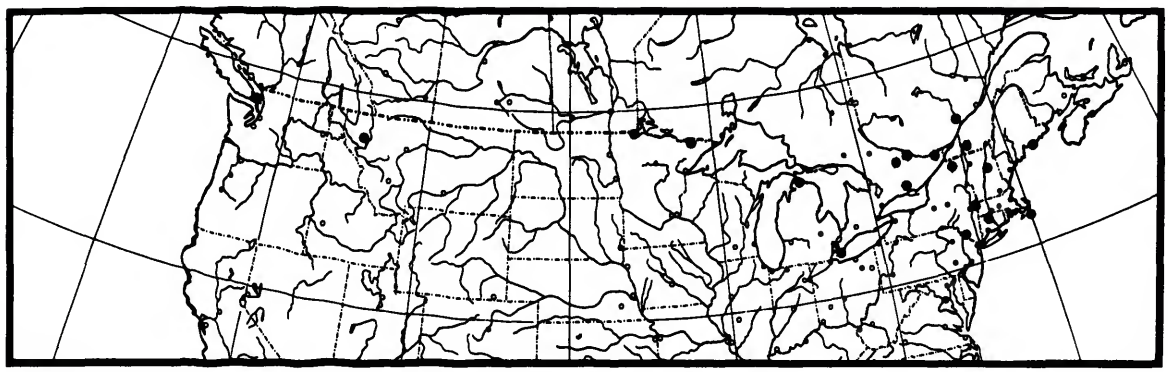


FIGURE 98.—*N. shewelli:* distribution map.

ETYMOLOGY.—The genitive patronym *shewelli* honors Guy E. Shewell, distinguished dipterist and friend, who collected the type-series.

GEOGRAPHIC DISTRIBUTION (Figure 98).—This species occurs in northern United States and southern Canada. Collection dates are from 3 June to 9 September.

REMARKS.—The type-series was collected from *Nuphar advena* (Ait.), a water lily that is widely distributed in eastern North America. This habitat is similar to that reported for the European species *N. brunnipes.* In the case of *N. brunnipes,* the eggs were laid on the flower of the water lily but the larvae and pupae developed, attached to the roots of a *Typha* species.

25. *Notiphila (Notiphila) solita* Walker

FIGURES 99–104

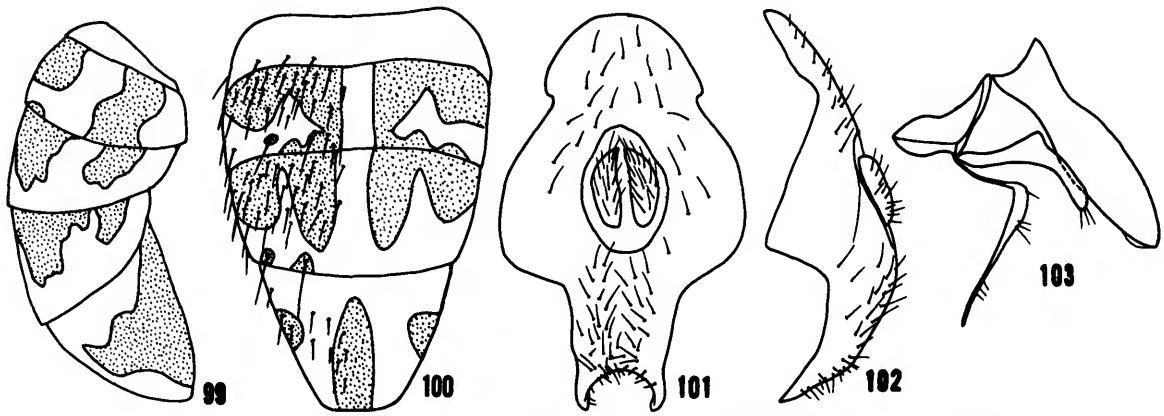
Notiphila solita Walker, 1853:406.
Notiphila vittata Loew, 1862:136.—Mathis, 1977b:537.
Notiphila (Agrolimna) solita.—Wirth, 1965:748.

TYPE-MATERIAL.—Lectotype male (herein designated): "68·4/US (United States)/solita/United States, W. W. Saunders. B.M. 1868-4/LECTOTYPE Notiphila solita Walker by W. N. Mathis (red)." The lectotype is in the British Museum (Natural History). The holotype female of the junior synonym bears the following label data: "Dista-Columb(ia). (green)/Loew Coll./vittat. ♀/Type 11127 (red)/Notiphila vittata Lw. det W. Wirth '61." This specimen is deposited in the Museum of Comparative Zoology, Harvard University, type number 11127.

DIAGNOSIS.—Specimens of this species very closely resemble those of *N. pauroura* and have often been confused with the latter. Like specimens of *N. pauroura,* the sides of the scutellum are blackish brown when viewed from a posteroblique angle. Specimens of *N. solita* may be distinguished from those of *N. pauroura* by the following combination of characters: Median stripe on mesonotum not as evident, in most specimens it is considerably weaker than lateral, mesonotal markings, usually the stripe is also weakly produced posteriorly; fifth abdominal tergum of *N. solita* males also as long as wide. Male genitalia are very distinct: Epandrium broadly produced toward middle but markedly tapering toward both ends; venter of epandrium projecting forward, terminating as a broadly U-shaped process (from a lateral view this process projects upward at an obtuse angle); basiphallus of aedeagus subelliptical; lobe of hypandrial process as long as base.

DESCRIPTION.—Moderately small to moderately large shore flies, length 2.81 to 4.25 mm; olive gray to light tannish gray in coloration with brown markings.

Head: Head ratio 1:0.71; postfrons ratio 1:0.70; frons with extreme lateral margins concolorous with face; median triangle and surrounding area of frons nearly concolorous, brownish gray, pollinose, although the triangular area slightly lighter. Paravertical bristle much large than postocellar setae, approximately twice their size; often without proclinate, fronto-orbital setae, if present, very small. First and second antennal segments dark brown except for anterodorsal surface of second, which is yellowish; third antennal segment mostly yellow-



FIGURES 99–103.—*N. solita:* 99, abdomen, lateral aspect; 100, same, dorsal aspect; 101, epandrium, cerci, and epandrial processes, posterior aspect; 102, same, lateral aspect; 103, internal male genitalia, lateral aspect.

ish orange, darker apically and dorsally; arista with 10–12 dorsal branches. Face light grayish yellow; prefrons ratio 1:0.61; facial setae with 3–4 setae that are subequal to postocellar setae. Eye ratio 1:0.75; eye-to-cheek ratio 1:0.14. Gena very narrow, concolorous with face anteriorly, becoming gray posteriorly genal bristle subequal to paravertical bristle. Maxillary palpus yellow.

Thorax: Mesonotum darker than pleural areas; median stripe of mesonotum weakly developed, especially posteriorly; mesonotum with vittate markings extending from anterior to presutural bristle, posterior through anterior supra-alar bristle area, across dorsum of notopleuron weakly developed. Lateral margin of scutellum appearing blackish brown as viewed from posterior angle. Mesopleuron with distinct vittate markings toward dorsal surface, extending from mesospiracle to larger bristles along posterior margin and along the posteroventral edge. Femora unicolorous, grayish black, apically pale; tibiae various, front tibia mostly dark, hind tibia only darkened preapical ring. All tarsi pale, yellow. Setal fascicle of hind basitarsus with 3 dark setae. Wing ratio 1:0.41; costal vein ratio 1:0.44; M_{1+2} vein ratio 1:0.67.

Abdomen: Abdomen ratio of males 1:0.50; length of fourth tergum to fifth tergum ratio of males 1:1.40; fifth tergum ratio of males 1:0.84. Terga with maculation pattern as in Figures 99–100. Male terminalia as in diagnosis and in Figures 101–103.

SPECIMENS EXAMINED (111).—CANADA: MANITOBA: International Peace Gardens-Turtle Mountain Forest Reserve (CNC). ONTARIO: Grand Bend (CNC); Kingston (ANSP); Marmora (CNC); Ottawa (CNC); Point Pelee (CNC). QUEBEC: Abbotsford (CNC); Fairy Lake (CNC); Kazabazua (CNC); Norway Bay (CNC). UNITED STATES: FLORIDA: Alachua Co., Gainesville (CNC); Dade Co., near Mahogany-Everglades National Park (FSCA), Highlands Hammock State Park (FSCA), Flamingo to Mahogany—Hammock in Everglades National Park (FSCA); De Soto Co., Fort Ogden (CNC); Duval Co., Jacksonville (ANSP). ILLINOIS: Cook Co., River Forest (USNM); Lake Co., Waukegan (ANSP, INHS); McHenry Co., Fox River Grove (USNM), McHenry (USNM); Winnebago Co., Rockford (AMNH). INDIANA: Tippecanoe Co., LaFayette (USNM). IOWA: Dickinson Co., Iowa Lakeside Laboratory (ISU); Hamilton Co., Goose Lake (USNM). MARYLAND: Calvert Co., Chesapeake Beach (USNM); Charles Co., Popes Creek (ANSP, MCZ). MICHIGAN: Manistee Co., Pierport (MSU); Monroe Co., Monroe (ANSP, USNM); Shiawassee Co., Owosso (USNM); Wayne Co., Detroit (USNM); Grosse Ile (USNM). NEBRASKA: Cherry Co., Snake Falls (USNM). NEW JERSEY: Forest Hill (ANSP); Burlington Co., Riverton (MCZ); Essex Co., Newark (AMNH, ANSP, FSCA), W Orange (USNM); Glaucester Co., Westville (MCZ). OHIO: Erie Co., Sandusky (ANSP, OSU); Franklin Co., (OHSU); Fulton Co., Wauseon (ANSP, OHSU); Portage Co., 1.6 km E Kent (KSU), 4.8 km E Kent (WNM), 7.2 km E Kent (KSU), 9.7 km S Kent (KSU), Mogodore Reserve (KSU); Wayne Co., 0.8 km S Rittman (KSU, USNM). PENNSYLVANIA: Crawford Co., Hartstown (USNM); Philadelphia Co., Philadelphia (MCZ). TEXAS: Galveston Co., Dickinson (ANSP). VIRGINIA: Independent City, Alexandria (ANSP, USNM).

GEOGRAPHIC DISTRIBUTION (Figure 104).—*Notiphila solita* occurs throughout eastern North Amer-

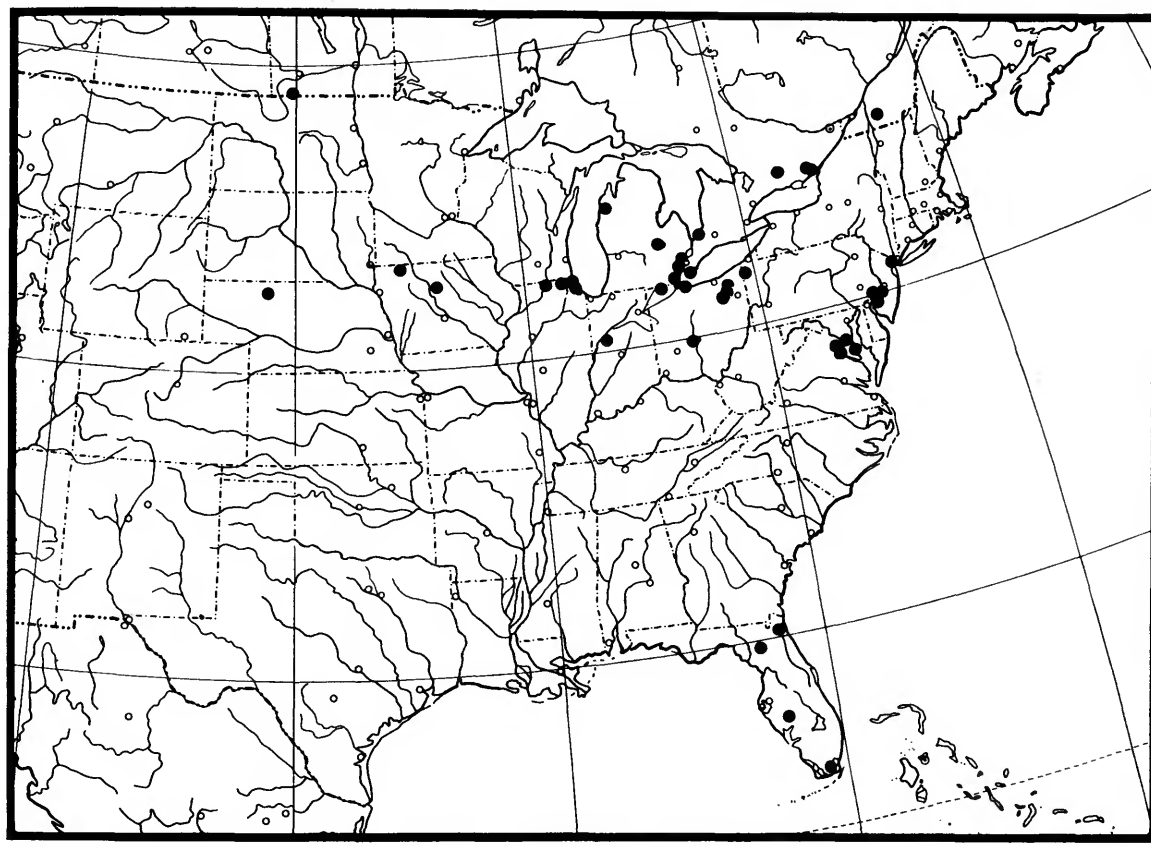


FIGURE 104.—*N. solita:* distribution map.

ica, although collecting records from the Southeast are few. Collection dates are from 9 April to 14 October.

REMARKS.—Until recently (Mathis, 1977b) the nomenclature of the senior synonym had been confusing. Wirth (1965) tentatively placed the name under subgenus *Agrolimna* (=*Dichaeta*), and earlier Cresson (1946) suggested that *N. solita* was possibly synonymous with *N. erythrocera*. After examining the types of both names, it became evident that they are conspecific, hence the changes indicated above.

Busacca and Foote (1978) conducted field and laboratory studies on the natural history of this species in cattail marshes in northeastern Ohio. The following is a summary of their work.

Adults of *N. solita* are relatively solitary and like most *Notiphila* rest head downward, although occasional specimens were observed on floating leaves of the yellow water lily (*Nuphar advena* W. Aiton).

The immature stages were found only in association with *Typha latifolia,* cattail, and all mature larvae and puparia were attached to its rootlets. Busacca and Foote analyzed the gut contents of larvae and found that they ingest bacteria and large amounts of detritus. They did not note any algal cells. Unlike larvae and puparia of the subgenus *Dichaeta,* those of *N. solita* have a very short respiratory tube. A timetable for the immature stages is as follows:

Eggs: 1–4 days, most larvae emerging in 2 days
First larval instar: 2–5 days
Second larval instar: 4–8 days
Third larval instar: probably several months, overwintering stage
Puparium: 2–20 days (field collected); average of 17 days (reared)

Notiphila solita frequently occurs sympatrically with *N. pauroura,* its most closely related congener.

Subgenus *Dichaeta* Meigen

Dichaeta Meigen, 1830:61 [type-species: *Notiphila caudata* Fallén, by monotypy].—Cresson, 1917:63–66 [review of North American species]; 1946:230–231 [review of North American species].—Sturtevant and Wheeler, 1954:236–237 [review and key to North American species].—Wirth, 1965:748 [catalog of North American species]. [New Status.]
Agrolimna Cresson, 1917:48 [as a subgenus of *Notiphila;* type-species: *Notiphila scalaris* Loew, by orginial designation; see generic synonymy]. [New synonym.]

DIAGNOSIS.—Middle tibia with either 3 or 4 erect bristles along dorsum, occasionally with 5 bristles; if 3, general body coloration uniformly dark brown; middle femur and tibia lacking a comblike row of setae along posteroventral margin; front coxa with 2 distinctly-larger setae along lower, anterolateral margin; 2 pair of proclinate, fronto-orbital setae laterad of larger, reclinate bristle, anterior seta larger; antenna and maxillary palpus black in the *scalaris* group, otherwise pale, yellowish to orange, at least apically; abdominal markings usually as fascia or occupying most of tergum, particularly abdominal terga 3 and 4; facial setae either more numerous, numbering up to 8 generally smaller, hairlike, or with 2–3 strong, bristlelike setae near ventral facial margin; epandrium usually not bearing any processes along ventral margin; surstyli well developed, usually subtriangular, frequently with a secondary lobe; hypandrial process large, often with preapical enlargement; hypandrial receptacle either cup-shaped, subdivided with each half broadly shaped like a half circle or parallelogram, or little evident; operculum and extending process of female ventral receptacle plain, without ornate processes, operculum considerably longer than wide; sixth and seventh abdominal segment of female terminalia usually not well sclerotized, frequently little remains except for setae and small, sclerotized spots around setal bases. Larva and puparium with respiratory tube well over half main body length.

DESCRIPTION.—Moderately small to moderately large shore flies, length 2.56 to 4.58 mm; background coloration variable, grayish brown to dark brown, if lighter, generally with darker brown to black markings.

Head: Head ratio 0.68–0.79 (mean of 0.74); postfrons ratio 0.49–0.75 (mean of 0.60); frons generally with median triangular area concolorous with lateral margins, lighter than remainder of mesofrons; darker areas often tinged with charcoal, sometimes appearing velvety and contrasting distinctly; some specimens with speckled-green reflections or with anterior margin grayish; frons usually lightly pollinose. Two pair of proclinate, fronto-orbital setae, generally small, anterior seta larger in members of the *caudata* group, both inserted laterad of larger, reclinate bristle. Antenna segments usually black, although with many exceptions. Face variable, niveous, light yellow, or brownish yellow, usually appearing pollinose to tomentose; facial setae either small, hairlike, and extending past middle facial height, or they are very well developed and confined to near ventral facial margin; prefrons ratio 0.54–0.75 (mean of 0.68). Eye ratio 0.69–0.83 (mean of 0.77); eye-to-cheek ratio 0.12–0.23 (mean of 0.19). Maxillary palpus variable, dark brown to black or pale, yellowish to orange.

Thorax: More or less brown to blackish brown in the *caudata* group, uniformly colored, otherwise as follows: Mesonotum usually immaculate but often vittate, darker than pleural areas; scutellum not appearing dark brown to black on lateral margins from posteroblique angle. Legs generally dark except for tarsi, these generally pale; middle femur and middle tibia lacking dense row of comblike setae on posteroventral margins; middle tibia with 4 prominent, dorsal extensor bristles. Setal fascicle of hind basitarsus usually pale, if dark then only 1 seta appearing so. Wing ratio 0.37–0.46 (mean of 0.42); costal vein ratio 0.36–0.60 (mean of 0.48); M_{1+2} vein ratio 0.80–1.20 (mean of 0.98).

Abdomen: Abdomen ratio of males 0.61–0.82 (mean of 0.73); length of fourth tergum to fifth tergum ratio of males 0.63–1.40 (mean of 0.92); fifth tergum ratio of males 0.45–0.70 (mean of 0.58). Darker markings if present usually fasciated and constrasting with lighter posterior margin and median stripes, sometimes occupying entire dorsum of tergum; fascia appearing most strongly on terga 3 and 4, fifth tergum often entirely dark. Male terminalia as follows: Epandrium with ventral margin subtruncate (the *scalaris* group), slightly produced ventrally (the *pulchrifrons* group), or produced ventrally with variously shaped processes (the *caudata* group); surstyli large, attached basally to

epandrium and to small process above hypandrial process, usually triangular in shape but often with secondary lobe bearing 3–4 small setae; hypandrial process large, much longer than wide, frequently with preapical enlargement and sinuate above; sclerotized basiphallus tapering apically; membranous distiphallus plain or with numerous, small, black spinules; hypandrial receptacle rudimentary or well developed, if the latter, lightly sclerotized, cup-shaped or flat and divided medially. See diagnosis for discussion of female terminalia.

Discussion.—This is primarily a New World taxon, although a few species occur in most faunal realms. In western North America, species of the subgenus predominate both in number of species and especially in specimen abundance. Only four species of this subgenus occur exclusively in eastern North America, *N. scalaris, N. elophila, N. furcata,* and *N. bispinosa.* The latter two species are restricted to coastal salt marshes.

Several species of the subgenus frequently occur together. This seems to be particularly true of *N. decoris, N. macrochaeta,* and *N. olivacea,* all of which are widespread and abundant. The sympatric occurrence of two or more species has facilitated species recognition and is a prime source of evidence for confirming the morphological integrity and limits of the included species.

Dichaeta species from North America may be conveniently divided into four species-groups. These are recognized primarily on a morphological basis. A more detailed account of each is found below.

Key to North American Species of the Subgenus *Dichaeta,* Exclusive of the *caudata* Group

1. Maxillary palpus pale, yellow to brownish orange at least apically 2
   Maxillary palpus entirely dark, usually black 7

2(1). Primary setae along posterior margin of fourth tergum of males approximately twice length of tergum; fifth tergum of males with two stout, closely appressed apical bristles; setal fascicle of hind basitarsi entirely pale 3
   Marginal setae of fourth tergum of males subequal to length of tergum; fifth abdominal tergum of males lacking apical stout bristles; setal fascicle of hind basitarsi various 4

3(2). Antennal segments entirely pale, yellow; arista usually with ten or fewer dorsally branching rays; fifth abdominal tergum of male subconical, not produced posteriorly into long, slender process ..... 29. **N bispinosa** Cresson
   Antennal segments mostly dark, basal portion of third segment often reddish yellow; arista usually with ten or more dorsally branching rays; fifth tergum of male produced posteriorly into slender process equal in length to apical bristles ..... 30. **N. furcata** (Coquillett)

4(2). Setal fascicle of hind basitarsi with at least one dark seta; hind tibia of male with prominent, crooked seta arising from apical anterior surface 6
   Setal fascicle of hind basitarsi entirely pale; hind tibiae of male lacking crooked seta 5

5(4). Antennal segments entirely dark; dorsum of mesonotum and scutellum immaculate; frons not conspicuously vittate, lateral margins not velvety black ..... 42. **N. pallidipalpis** Cresson
   Third antennal segment at least partially pale, second segment sometimes pale; dorsum of mesonotum and usually scutellum with brown stripe; frons vittate, lateral margins often velvety black, distinctly contrasting with coloration of mesofrons ..... 26. **N. pulchrifrons Loew**

6(4). Dark fascia of abdominal terga three and four conspicuous, inner portion reaching posterior margin of tergum, trigonal ..... 27. **N. hamifera** Wheeler
   Dark fascia of abdominal terga three and four weakly developed, inner portion not attaining posterior margin of tergum ..... 28. **N. scoliochaeta,** new species

7(1). Setal fascicle of hind basitarsi with at least one dark seta 8
   Setal fascicle of hind basitarsi entirely pale, regardless of tarsal color 10

8(7). Front tarsi yellow; mesopleuron with brown spot ..... 36. **N. deserta,** new species
   Front tarsi dark brown to black; mesopleuron usually lacking well defined brown spot 9

Key to North American Species of the Subgenus *Dichaeta*, Exclusive of the *caudata* Group (cont'd)

9(8). Black seta of hind basitarsi long, at least one-third length of basitarsus of male; fifth tergum of female with mesoapical membranous area .....38. **N. macrochaeta** Loew
Black seta of both sexes short, subequal to pale setae; fifth tergum of female lacking membranous area .....34. **N. decoris** Williston

10(7). Dark fascia of fourth abdominal tergum scarcely attaining lateral margin, not generally continuing on ventral surface 11
Dark fascia of fourth abdominal segment broadly attaining lateral margin, continuing on ventral surface 18

11(10). All tarsi dark brown to black .....47. **N. uliginosa** Haliday (melanic form)
Middle and hind tarsi generally pale, yellow to orange 12

12(11). Mesopleuron with brown maculation area distinct from lighter background color; mesonotum vittate .....31. **N. aenigma** Cresson
Mesopleuron without definite brown maculation area; mesonotum not vittate 13

13(12). Dark fascia of fourth abdominal tergum subdued, not contrasting greatly with lighter areas, especially toward posterior margin 14
Dark fascia of fourth abdominal tergum distinct, decidedly contrasting with lighter areas 15

14(13). Preapical enlargement of hypandrial process with apical margin angulate, not rounded or straight .....47. **N. uliginosa** Haliday (Great Lakes form)
Preapical enlargement or hypandrial process with apical margin evenly rounded or straight, not angulate .....47. **N. uliginosa** Haliday (pale form)

15(13). Eight or fewer aristal branches; dark fascia of fourth abdominal tergum subquadrate to triangular; aedeagal apodeme triangular .....37. **N. elophila,** new species
Generally ten or more aristal branches; dark fascia of fourth abdominal tergum rectangular to angulate; aedeagal apodeme subquadrate 16

16(15). Ventral margin of aedeagal apodeme scalloped; hypandrial process as in Figure 175 .....43. **N. paludia,** new species
Ventral margin generally straight; hypandrial process not as above 17

17(16). Preapical enlargement of hypandrial process preceded by a distinct depression; apical surface less angulate and apices projecting .....41. **N. olivacea** Cresson
Preapical enlargement of hypandrial process preceded by a more gently formed depression; apical surface or enlargement more angulate to overall plane of process .....35. **N. deonieri,** new species

18(10). All tarsi generally dark brown to black 21
At least middle and hind tarsi yellowish 19

19(18). Front tarsi entirely dark, black or dark brown .....39. **N. minima** Cresson
Front tarsi generally pale, slightly darkened in some specimens 20

20(19). Mesopleuron with definite brown spot; antennal segments entirely black .....45. **N. scalaris** Loew
Mesopleuron lacking definite spot; base of third antennal segment usually reddish yellow .....46. **N. sicca** Cresson

21(18). Mesonotum with median stripe that bifurcates posteriorly 22
Mesonotum generally immaculate 23

22(21). Mesopleuron with distinguishable brown spot near middle; dark abdominal fascia on third, fourth, and fifth terga extending to posterior margin; male terminalia as in Figures 136–138 .....32. **N. atrata,** new species
Mesopleuron generally lacking brown spot near middle; dark abdominal fascia terminating before posterior margin; male terminalia as in Figures 178–181 .....44. **N. quadrisetosa** Thomson

23(21). Specimens large, length up to 4.1 mm; male terminalia as in Figures 139–142 .....33. **N. atripes** Cresson
Specimens generally smaller, length seldom over 3.5 mm; male terminalia as in Figures 165–166 .....40. **N. nanosoma,** new species

The *pulchrifrons* Group

SPECIES INCLUDED.—*Notiphila hamifera* Wheeler; *N. pulchrifrons* Loew; *N. scoliochaeta,* new species.

DIAGNOSIS.—General body coloration gray to light grayish brown, but with some brown markings; abdominal terga usually fasciated, although fascia in many specimens faint, if present light brown; maxillary palpus pale, yellowish; usually 1 or more antennal segments with some pale coloration; facial setae generally small, hairlike; anterior proclinate, fronto-orbital seta not much larger than posterior one; lateral margins of frons usually distinctly colored, dark, frequently velvety; middle tibia with 4 erect bristles along dorsum, arranged 1.1.1.1.; fourth and fifth terga of males normally developed; hypandrial process of male terminalia very long and slender, frequently curved apically; ventral margin of epandrium somewhat produced into a symmetrical process (see Figures 107–112, 115, 119); surstyli with lateral lobe well-developed, basically subrectangular; hypandrial receptacle well sclerotized as 2 semicircular plates. Immature stages not described.

GEOGRAPHIC DISTRIBUTION.—The Nearctic species of this group occur primarily below 40° north latitude but extend well into the Neotropics.

DISCUSSION.—Three Nearctic species are included in this group. Specimens of an African species, *N. bipunctata* Loew, apparently share many of the character states that I use to recognize this group and it may prove to belong here. Specimens of that species, like those of *N. pulchrifrons* have velvety-black patches on the lateral margins of the frons.

26. *Notiphila (Dichaeta) pulchrifrons* Loew

FIGURES 105–114

Notiphila pulchrifrons Loew, 1872:102.
Notiphila (Agrolimna) pulchrifrons.—Cresson, 1917:55.
Notiphila (Agrolimna) frontalis var. *signata* Cresson, 1917:57.
Notiphila (Agrolimna) signata.—Wirth, 1965:748.

TYPE-MATERIAL.—Holotype male: "Texas Left. (?)(green)/Loew Coll./pulchrifrons Lw. Cent. X./ Type 11130 (red)." The holotype is in the Museum of Comparative Zoology, Harvard University, type number 11130. Loew's original description also cited Belfrage as the collector. The label data of the male holotype of *N. signata* are as follows: "Thalman(n), April 28, 11 (1911) G(eorgi)a./Holo-TYPE ♂ Notiphila signata E. T. Cresson Jr (red)/HOLOTYPE Cornell U., No. 1663.1 (red)." The holotype of *N. signata* is in the Cornell University insect collection, Ithaca, type number 1663.1. Cresson's original description of *N. signata* also lists 2 male and 4 female paratopotypes.

DIAGNOSIS.—*Notiphila pulchrifrons* is one of the most distinctive members of the subgenus *Dichaeta,* and it is not likely to be confused with any other species. Specimens may be distinguished from those of similar congeners by their small size, by their conspicuously vittate mesonotum, by the pale maxillary palpus and antennal segments, and by the velvety-black, parafrontal stripes. The genitalia of males are also diagnostic (Figures 105–113).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.40 to 3.12 mm; with light brown to grayish brown background coloration and brown markings.

Head: Head ratio 1:0.77; postfrons ratio 1:0.53; frons with 2 conspicuously marked, velvety-black, parafrontal stripes; remainder of frons whitish gray, but often with a mesofrontal stripe also. Paravertical bristle small, only slightly larger than postocellars; usually with 2 pair of proclinate, fronto-orbital setae. First and second antennal segments mostly pale but with some darker brown coloration; third antennal segment mostly yellowish orange but usually darker along anterodorsal margin; arista with approximately 11 dorsal branches. Face yellow, subcarinate; prefrons ratio 1:0.61; facial setae very small, hairlike, numbering 6–7. Eye ratio 1:0.77; eye-to-cheek ratio 1:0.19. Gena narrow, concolorous with face anteriorly, becoming grayer posteriorly; genal bristle nearly twice the size of paravertical bristle. Maxillary palpus pale, yellowish orange.

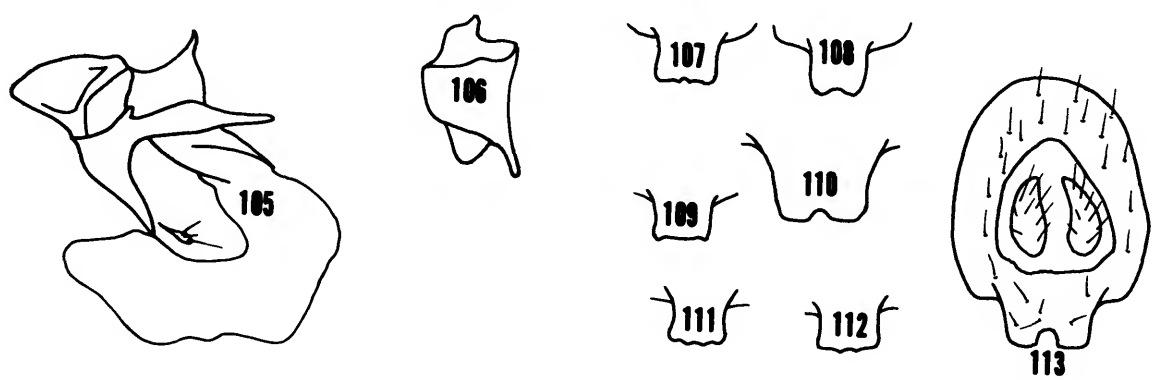
Thorax: Mesonotum darker than pleural areas, slightly lighter in coloration anteriorly, conspicuously vittate with a medium, bifurcating stripe and 2 stripes on either side. Scutellum also vittate. Mesopleuron usually with a darker maculation area, otherwise pleural areas mostly grayish brown. Femora and tibiae mostly dark brown to black, but with considerable gray, dusted areas, becoming pale apically; tarsi pale. Setal fascicle of hind basitarsus pale. Wing ratio 1:0.43; costal vein ratio 1:0.56; M_{1+2} vein ratio 1:0.94.

Abdomen: Abdomen ratio of males 1:0.81; length of fourth tergum to fifth tergum ratio of males

1:0.71; fifth tergum of males 1:0.45. Markings on abdomen variable, fascia-like to guttate. Male genitalia as in Figures 105–113.

SPECIMENS EXAMINED (1439).—ARIZONA: Catalina Mountains (UA, USNM); Granite Dell (KU); Cochise Co., Chiricahua Mountains (USNM); Herb Martyr Dam (FSCA, USNM); Sunnyside Canyon-Huachuca Mountains (ANSP, KU, USNM); Coconino Co., Bill Williams Forest (ANSP, KU), Oak Creek Canyon-Sedona (KU, MSU, USNM); Maricopa Co., Wickenburg-Hassayampa River (USNM), Santa Cruz River (UA); Santa Cruz Co., Ruby (KU), Sonoita Creek 9.7 km E. Patagonia (KSU); Gila Co., E. Verde River 8.1 km N. Payson (WNM); Yavapi Co., Prescott (USNM). CALIFORNIA: Mojave Desert (USNM); Ortega Highway (USNM); Alameda Co., Sunol Valley Park (CAS); Butte Co., Oroville (CAS); Inyo Co., 4.8 km N. Lone Pine (UCB), Shoshone (CAS), Warm Sulphur Springs (UCR); Kern Co., Bakersfield (ANSP, CAS), Kernville (KU, USNM), Onyx (KU, USNM), Rosamond (KU); Los Angeles Co., Angeles Bay Gulf (ANSP, CAS), Azusa (USNM), Los Angeles (CAS), Los Angeles River (ANSP, CAS); Mendocino Co., Echo (KU); Monterey Co., Pleyto (CAS); Orange Co., Atwood (USNM), Buena Park (USNM), Capistrano Hot Springs (USNM), San Juan Hot Springs (USNM); Riverside Co., Anza (KU), Deep Canyon (UCR), USNM), Lake Hemet (UCR), Palm Canyon-Palm Springs (CNC), Riverside (USNM); Sacramento Co. (KU); San Bernardino Co., Cajon (USNM), Cajon Pass (USNM), Chino (USNM), Morongo (USNM), Victorville (CU, USNM); San Diego Co. (KU), Borrego (UCB), Descanso (ANSP), Desert edge (ANSP, CAS), 40.3 km N. Ensenada (USNM), Jacumba Springs (KU, USNM), Lake Henshaw Dam (UCR, USNM), Mount Buckman (CAS), Warner Spring (UCD); San Luis Obispo Co., Alamo Creek (UCB, USNM); Santa Clara Co., San Antonio Valley (UCB); Sonoma Co., Cloverdale (CU); Sutter Co., Live Oak Park (USNM); Tulare Co., Terminus Reservoir (UCR), Three Rivers (ANSP, USNM), Visalia (USNM); Ventura Co., Piru (UCB, USNM). COLORADO: Regnier (AMNH). GEORGIA: Glynn Co., Thalmann (ANSP, CU); Liberty Co., Saint Catherines Island (AMNH). INDIANA: Vanderburgh Co., Evansville (ANSP, USNM). KANSAS: Hamilton Co., (KNSU); Kingman Co., (ANSP, KU); Mitchell Co. (KNSU); Pottawatomie Co. (KNSU); Riley Co., Manhattan (KNSU). MARYLAND: Cecil Co., Chesapeake Beach (USNM). MISSISSIPPI: Noxubee Co., Shuqualak (KU). MISSOURI: Lawrence Co. (WNM); Saint Louis Co., Saint Louis (USNM). NEBRASKA. Chase Co., 16.1 km SW. Imperial (UN); Hamilton Co., Hordville (UN, USNM). NEVADA: Washoe Co., Sparks (CAS). NEW MEXICO: Colfax Co., Springer (USNM); Grant Co., Mangus Springs 17.7 km S. Cliff (WNM); Hidalgo Co., 32.2 km S. Rodeo (UCR); Sandoval Co., Jemez Mountains (ANSP); San Miguel Co., 0.8 km NE Montezuma (WNM). OHIO: Champaign Co., Cedar Swamp (KSU); Franklin Co. (OHSU). OKLAHOMA: Platt National Park (ANSP). TEXAS: Weser (KU); Brewster Co., Big Bend National Park (USNM), Marathon (KU), 8.1 km S Marathon (USNM); Brooks Co. (KU); Comal Co., New Braunfels (ANSP); Galveston Co., Dickinson (ANSP), Galveston (USNM); Gillespie Co., Pedernales River (USNM); Hays Co., San Marcos (USNM); Jackson Co., (KU); Jim Wells Co. (KU, USNM); Kerr Co., Hunt-Guadalupe River (USNM), Kerrville (ANSP), 16.1 km NE Kerrville (UMN), Henke Pond-Kerrville (USNM); Kimble Co., Roosevelt (USNM); Llano Co., Enchanted Rock (USNM); Sutton Co. (KU); Travis Co., Austin (USNM); Val Verde Co., 32.2 km E Del Rio (USNM), Devils River-Juno (CNC, USNM), Garner State Park (USNM); Walker Co., Sam Houston National Forest-Stubblefield Lake Camp (USNM). UTAH: Emery Co., Green River (UMN, USU); Grand Co., Moab (ISU, UMN); Kane Co., Kanab River (USU); Sanpete Co., Fairview (USU); San Juan Co., 10.5 km N LaSal Junction (WNM); Washington Co., Leeds (UMN, USNM, USU); Wayne Co., Capital Reef (USU).

GEOGRAPHIC DISTRIBUTION (Figure 114).—*Notiphila pulchrifrons* ranges from California to Georgia, as far north as Nebraska and Indiana, and southward into the tropics of Central America. Collection dates are from 15 March to 16 November.



FIGURES 105–113.—*N. pulchrifrons:* 105, internal male genitalia, lateral aspect; 106, surstylus, lateral aspect; 107-112, epandrial processes (107, Georgia; 108, Texas; 109, Kansas; 110, New Mexico; 111, Nebraska; 112, California) ; 113, epandrium, cerci, and epandrial processes, posterior aspect.

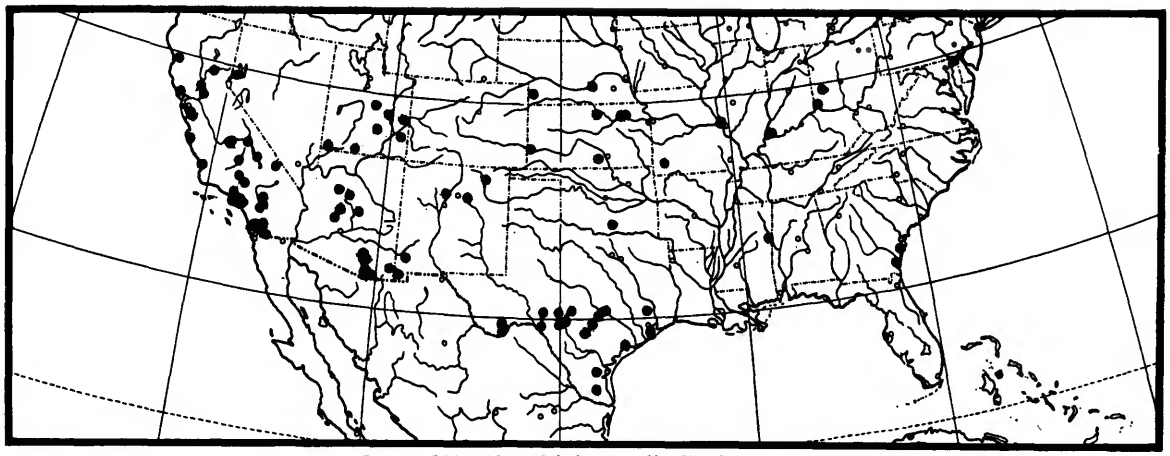


FIGURE 114.—*N. pulchrifrons*: distribution map.

REMARKS.—*Notiphila pulchrifrons* is one of the most variable species of *Notiphila*. Variation tends to be geographically limited, and some of the varying populations have been given subspecific and/or specific status. I prefer not to recognize these until a more thorough study is made and more Nearctic material is available. Most of the variation is limited to the development of the mesonotal stripes and to the degree of velvet pollinosity expressed on the lateral margins of the frons. The conformation of the ventral margin of the epandrium also varies from population to population.

This species, together with *N. hamifera* and *N. scoliochaeta,* form a fairly distinct group that I suspect is primarily tropical in origin. *Notiphila pulchrifrons* occurs throughout the tropics under the name of *N. frontalis.*

27. *Notiphila (Dichaeta) hamifera* Wheeler

FIGURES 115–118

Notiphila (Agrolimna) hamifera Wheeler, 1961:87.

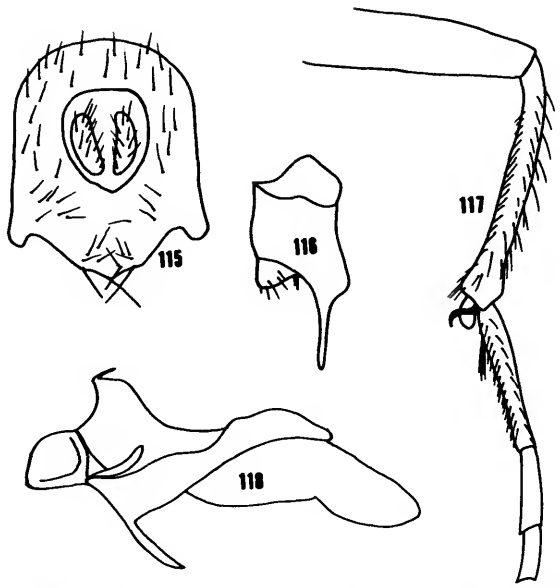
TYPE-MATERIAL.—Holotype male: "Oak Cany(on) Ariz(ona) 6·21·(19)51 (handwritten, white)/M. R. Wheeler Collectors/Holotype Notiphila hamifera Wheeler (handwritten, pink)." The holotype and allotype are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.; no type number has been assigned. Wheeler's original description also listed two male paratopotypes and one male paratype from Decker, Colorado, 25 August 1950.

DIAGNOSIS.—Specimens of *N. hamifera* closely resemble those of *N. scoliochaeta* but may be distinguished by the following combination of characters: Specimens usually larger; maculation pattern of abdomen more extensively developed; abdominal fascia reaching lateral and posteromedial margins, much darker in color; base of third antennal segment generally yellowish; hypandrial process slightly sinuate dorsally and apically; enlarged prebasal section of hypandrial process more extensive (Figures 115–116, 118).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.40 to 4.30 mm; with grayish brown coloration and dark brown markings.

Head: Head ratio 1:0.78; postfrons ratio 1:0.60; 2 pair of proclinate, fronto-orbital setae; paravertical bristle small, slightly larger than facial setae; large, light-colored, medium triangular area surrounding ocellar triangle and extending to anterior margin of frons, unicolorous with extreme lateral margins of frons; remainder of frons subdued, charcoal black. Antenna generally black except for base of third antennal segment, which is yellowish; aristal branches numbering 10–12. Face whitish yellow; prefrons ratio 1:0.63; facial setae hairlike. Eye ratio 1:0.77; eye-to-cheek ratio 1:0.25; genial bristle distinct. Maxillary palpus yellowish orange.

Thorax: Mesonotum vittate; mesopleuron with brown maculation toward dorsal border. Ground



FIGURES 115–118.—*N. hamifera:* 115, epandrium, cerci, epandrial processes, posterior aspect; 116, surstylus, lateral aspect; 117, hind leg, posterior aspect; 118, internal male genitalia, lateral aspect.

color of thorax generally unicolorous, although pleural areas usually lighter, grayer. Femora grayish black; front tibia partially dark apically, otherwise yellow; other tibiae light, yellowish orange except for dark ring on hind tibia; hind tibia with apical process as in Figure 117; all tarsi yellow. Setal fascicle of hind basitarsus light, yellow. Wing ratio 1:0.41; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:0.91.

Abdomen: Abdomen ratio of males 1:0.81; length of fourth tergum to fifth tergum ratio of males 1:0.96; fifth tergum ratio of males 1:0.64. Abdominal fascia dark brown, extensive, attaining lateral and posteromedial margins. Male terminalia as in diagnosis and Figures 115–116, 118).

SPECIMENS EXAMINED.—Eleven specimens from the following locality: ARIZONA: Coconino Co., Oak Creek Canyon (USNM).

GEOGRAPHIC DISTRIBUTION.—The type-locality, Oak Creek Canyon, Arizona, and possibly Decker, Colorado, are the only sites where *N. hamifera* has been collected.

REMARKS.—This species could be confused only with *N. scoliochaeta;* it is distinguished from the latter as indicated above in the key and diagnosis.

All specimens that I have examined that resemble either of these two species, other than those from the type-locality of *N. hamifera,* have been *N. scoliochaeta.* Although I did not examine the male paratype from Decker, Colorado, I suspect that it is also a specimen of *N. scoliochaeta.*

28. *Notiphila (Dichaeta) scoliochaeta,* new species

FIGURES 119–122

DIAGNOSIS.—Specimens of *N. scoliochaeta* are very similar to those of *N. hamifera* but may be distinguished from the latter as follows: Specimens generally smaller, although some nearly as large as *N. hamifera;* maculation pattern of abdominal fascia much less developed, contrasting only slightly with background coloration; median extensions never reaching posterior margins of terga; base of third antennal segment usually black or if lighter in color, lighter area not as extensive. The terminalia of males of *N. scoliochaeta* are also quite similar to that of males of *N. hamifera,* but the long hypandrial process is evenly arched apically and not sinuate above, and the prebasal swelling is not as extensive (Figures 119–122).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.40 to 4.20 mm; with grayish brown to gray coloration.

Head: Head ratio 1:0.71; extreme lateral margins of frons whitish gray, concolorous with median triangular area; otherwise frons dull black; anterior of median ocellus with a brown spot; postfrons ratio 1:0.57; paravertical bristle small, subequal to facial setae; 2 pair of subequal, proclinate, frontoorbital setae. Antennal segments black, sometimes base of third segment lighter; 10–12 aristal branches; face subdued, golden yellow; parafacials usually lighter; prefrons ratio 1:0.71; facial setae small, hairlike. Eye ratio 1:0.71; eye-to-cheek ratio 1:0.25; genal bristle approximately subequal to posterior ocellar bristles; gena whitish gray. Maxillary palpus pale, orangish yellow.

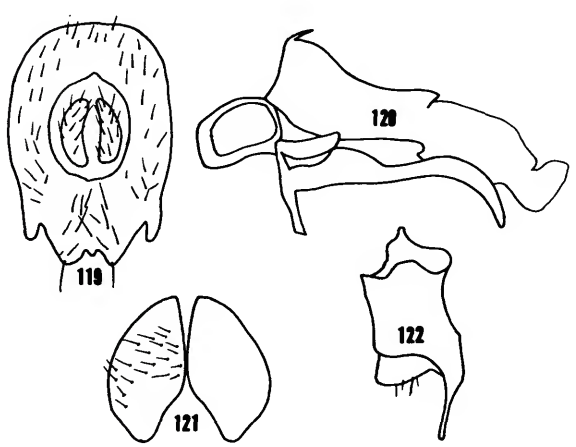
Thorax: Mesonotum brownish gray with rather subdued median stripe that bifurcates posteriorly; mesopleuron with only a slightly brownish area, otherwise gray, concolorous with other pleural areas. Femora blackish gray; front tibia basally yellow, apically darker, black; other tibiae yellow; all tarsi

yellow, although some with darkened ring near middle; hind tibia with apical processes as in *N. hamifera* (Figure 117). Setal fascicle of hind basitarsus light, yellow. Wing ratio 1:0.44; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:0.93.

Abdomen: Abdominal ratio of males 1:0.76; length of fourth tergum to fifth tergum ratio in males 1:1; fifth tergum of males 1:0.65. Maculation pattern on dorsum of abdominal segments weakly developed, fascia generally not reaching lateral or posterior margins. Male terminalia as in diagnosis and in Figures 119–122.

TYPE-MATERIAL.—Holotype male: "UTAH San Juan Co. 6½ mi [10.5 km] N LaSal Junc(tion), 22 June 1973, Wayne N. Mathis/HOLOTYPE Notiphila scoliochaeta Mathis (red)." Allotype and 26 paratypes (12♂, 14♀): with same label data as the holotype. Other paratypes as follows: 1♂, Arizona, Patagonia, Sonoita Creek, 2 October 1970, B. A. Foote Collector. The holotype, allotype, and two paratypes will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73547.

ETYMOLOGY.—The epithet *scoliochaeta,* of Greek derivation, is a combination of the adjective *scoli* ("curved" or "crooked") plus the noun *chaeta* ("bristle") in allusion to the distinct, crooked bristle at the apex of the hind tibia.



FIGURES 119–122.—*N. scoliochaeta*: 119, epandrium, cerci, epandrial processes, posterior aspect; 120, internal male genitalia, lateral aspect; 121, hypandrial receptacles, ventral aspect; 122, surstylus, lateral aspect.

GEOGRAPHIC DISTRIBUTION.—Specimens of *N. scoliochaeta* have been found in southeastern Utah and southern Arizona. Collection dates are from 22 June to 2 October.

REMARKS.—The type-specimens were collected along the banks of a small, freshwater creek. The only emergent vegetation was a *Carex* species. The adults of this species, *N. pulchrifrons,* and a *Chrysops* species (Tabanidae) were abundant at this locality.

Like specimens of *N. hamifera,* members of this species have a prominent, crooked seta at the apex of the hind tibia in males. I suspect that other species belonging to this species-group will be discovered in Mexico when the *Notiphila* fauna from that area becomes better known.

The *furcata* Group

SPECIES INCLUDED.—*Notiphila bispinosa* Cresson; *N. furcata* (Coquillett).

DIAGNOSIS.—General body coloration gray to grayish brown, but with some darker markings; abdominal terga mostly fasciated, gray posteriorly, along lateral margins, and sometimes medially, but with dark brown fascia along anterior margins; maxillary palpus pale apically, yellowish orange; antenna variable, first and second segments usually dark brown to black, third segment pale to mostly dark colored; facial setae small, usually hairlike; anterior proclinate, fronto-orbital seta only slightly larger than posterior one; middle tibia with 4 erect bristles along dorsum, arranged 1.1.1.1.; fifth tergum of male produced posteriorly, forming either a slender tube or less well-developed process, both terminating with 2–3 larger bristles; fourth tergum of males with markedly larger setae along posterior margin; male terminalia as in the *scalaris* group. Immature stages not described.

GEOGRAPHIC DISTRIBUTION.—Both species of this group occur along the Atlantic and Gulf Coasts of North America from Nova Scotia south to Texas.

DISCUSSION.—A Japanese species, *N. sekiyai* Koizumi, may also belong to the *furcata* group. Miyagi (1966) redescribed that species and mentioned that the fifth tergum of the male abdomen is produced into a cylindrical tubercle with two stout, upcurved, apical bristles. I have not examined any specimens of this species.

29. *Notiphila (Dichaeta) bispinosa* Cresson

FIGURES 123–127

Notiphila (Agrolimna) bispinosa Cresson, 1917:58.

TYPE-MATERIAL.—Holotype male: "Barnegat City Ju(nction). VIII-11-10., N.J./♂/TYPE Notiphila BISPINOSA, E.T. Cresson, Jr. 6114." The holotype is in the Academy of Natural Sciences of Philadelphia, type number 6114. Cresson's original description cites H. S. Harbeck as the collector of the type although the type does not have any indication of a collector. Cresson also listed a male paratopotype.

DIAGNOSIS.—Specimens of this species are very distinctive and are not likely to be confused with those of any congeners of the subgenus *Dichaeta*. Specimens are similar to those of *N. furcata* in the development of the secondary male sex structures of the fourth and fifth abdominal terga, although they are not as elaborate or as well developed. The posterior end of the fifth tergum does not project backward into a slender process, but it does bear 2–3 terminal bristles. Moreover, the large bristles along the posterior margin of the fourth tergum are not as strongly developed nor as numerous as those of *N. furcata* males. The antenna of *N. bispinosa* members is entirely yellow and generally there are fewer aristal branches. The hypandrial process of *N. bispinosa* males differs in several details from that of *N. furcata* males. For a comparison, see Figures 124 and 130.

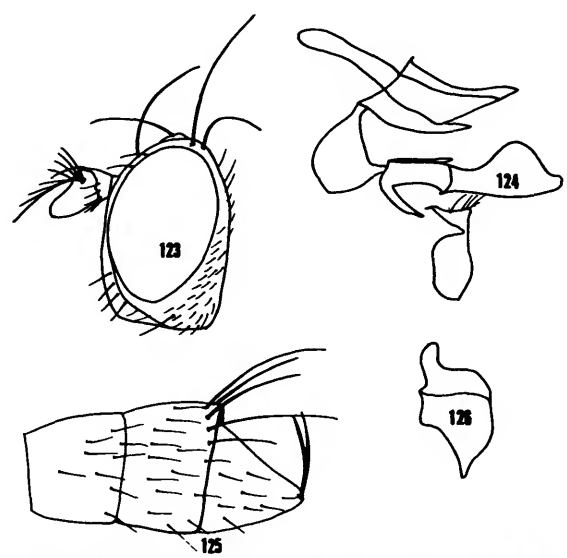
DESCRIPTION.—Moderately small to moderately large shore flies, length 2.86 to 4.15 mm; with olive brown to grayish brown coloration and brown markings.

Head (Figure 123): Head ratio 1:0.75; postfrons ratio 1:0.59; lateral margins and median triangular area of frons concolorous, light brown, pollinose; remaining area of frons blackish gray with some metallic green luster. Paravertical bristle large, much larger than postocellar bristles; 2 pair of proclinate, fronto-orbital setae. Antenna entirely pale, yellow but sometimes with darker discoloration on third segment; usually 8–10 dorsal aristal branches. Face cinereous to niveous; prefrons ratio 1:0.67; facial setae small, hairlike. Eye ratio 1:0.81; eye-to-cheek ratio 1:0.16. Genal bristle subequal to paravertical bristle; gena not sharply contrasting with facial color. Maxillary palpus pale, yellow.

Thorax: Mesonotum immaculate, olive gray anteriorly, becoming light brown posteriorly. Mesopleuron with a brown maculation spot; pleural areas generally lighter in color than mesonotum, but becoming grayer ventrally. Femora grayish black; front tibia darkened, black although with pale, yellowish apices; middle and hind tibiae and all tarsi pale, yellow. Setal fascicle of hind basitarsus entirely pale. Wing ratio 1:0.40; costal vein ratio 1:0.53; M_{1+2} vein ratio 1:0.95.

Abdomen (Figure 125): Abdomen ratio 1:0.71; length of fourth tergum to fifth tergum ratio of males 1:0.95; fifth tergum ratio of males 1:0.60. Fascia of abdominal terga light brown, but contrasting with gray, ground color; fascia extending to lateral margins and on ventral surfaces. Posterior margin of fourth tergum with 7–9 large bristles, almost twice the length of fourth tergum; 2–3 stout bristles (Figure 125). Male terminalia as in Figures 124, 126.

SPECIMENS EXAMINED (403).—CANADA: NOVA SCOTIA: Backman's Beach (CNC), Lockeport (CNC), Petite Riviere (CNC), Petpeswick (CNC), Smith's Cove (CNC, USNM). PRINCE ED-



FIGURES 123–126.—*N. bispinosa:* 123, head, lateral aspect; 124, internal male genitalia, lateral aspect; 125, abdomen, lateral aspect; 126, surstylus, lateral aspect.

WARD ISLAND: Alberton (CNC). UNITED STATES: CONNECTICUT: Fairfield Co., Westport (ANSP); Middlesex Co., Plum Bank Beach (CU); New Haven Co., Guilford (CU); New London Co., Mystic (KU). DELAWARE: Bombay Hook (CU); Saint Jones River (CU); Woodland Beach (CU); Sussex Co., Lewes (KSU). FLORIDA: Levy Co. (FSCA); Manatee Co., Bradentown (CAS); Saint Johns Co., Crescent Beach (CU), Saint Augustine (ANSP, MCZ). GEORGIA: Barn Co., Espelo I. (USNM); Chatham Co., Savannah (WSU); Glynn Co,, Brunswick-Torras Causeway (CU), 0.3 km W Jekyll Island (CU); Liberty Co., Saint Catherines Island (AMNH); McIntosh Co., Sapelo Island (UG, USNM). LOUISIANA: Cameron Parish, Cameron (ANSP, OHSU), 9.7 km S Hackberry (WNM); Saint Tammany Parish, 10.5 km W Rigolets River (CU). MAINE: Trenton (USNM, ANSP); Hancock Co., Mount Desert (MCZ, USNM); Lincoln Co. (OHSU, USNM), Medomak (OHSU); Washington Co., Machias (ANSP, MCZ). MARYLAND: Seaside (ANSP, USNM); Calvert Co., Chesapeake Beach (ANSP, USNM); Dorchester Co., Lloyds (USNM); Saint Marys Co., Piney Point (USNM), Saint George Island (USNM). MASSACHUSETTS: Naushon Island (USNM), Pasque Island (USNM); Welfleet (USNM); Woebecker Island (USNM); Barnstable Co., Falmouth (USNM); Eastham (ANSP, CNC, CU), North Falmouth (USNM), Mashpee (USNM), Pocasset (USNM), South Yarmouth (USNM), Woods Hole (ANSP, USNM); Bristol Co., New Bedford (MCZ, USNM); Essex Co., Ipswich (CAS, MCZ, USNM), Lynn (ANSP); Nantucket Co., Nantucket (MCZ). NEW JERSEY: Anglesea (ANSP), Ducan Island (AMNH); Cape May Co., Cape May (ANSP, MCZ), Stone Harbor (ANSP), Wildwood (ANSP); Mercer Co., Trenton (USNM); Monmouth Co., Morganville (AMNH); Ocean Co., Barnegat City Junction (ANSP), 4.8 km S Tuckerton (USNM). NEW YORK: Jamaica Co., Howard Beach (UMN); Nassau Co., Jones Beach State Park (MSU), Long Beach (USNM); Richmond Co., Staten Island (USNM); Suffolk Co., Babylon (CU), Cold Springs Harbor (AMNH, ANSP, CU, FSCA, USNM). TEXAS: Galveston Co., Dickinson (ANSP). VIRGINIA: Accomack Co., Assateague Island (WNM, CU), Chincoteague Island (CU), Eel Creek Marsh-E. of Chincoteague (CU); York Co., York River (ANSP).

GEOGRAPHIC DISTRIBUTION (Figure 127).—*Notiphila bispinosa* occurs along the Atlantic and Gulf Coasts of North America. Collection dates are from 27 March to 8 September.

REMARKS.—This species and *N. furcata* are the obvious links between the *caudata* Group and the remaining taxa of the subgenus *Dichaeta* because of the unusual development of the fourth and fifth abdominal segments of male specimens. The genitalia of males clearly associate members of *N. bispinosa* with the subgenus, being very similar to those of the *scalaris* group.

Denno (1965, pers. comm.) reported that this species is commonly collected in salt marshes in New Jersey.

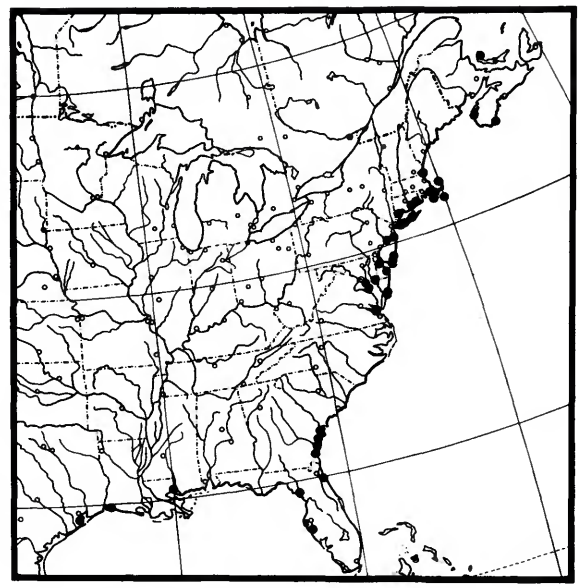


FIGURE 127.—*N. bispinosa:* distribution map.

30. *Notiphila (Dichaeta) furcata* (Coquillett)

FIGURES 128–132

Dichaeta furcata Coquillett, 1902:182.
Notiphila (Agrolimna) furcata.—Cresson, 1917:59.

TYPE-MATERIAL.—Lectotype male (designated by Cresson, 1917:59): "Bisc(ayne). Bay, Fl(orid)a./ Collector Mrs. Slosson/Type No. 6640 U.S.N.M./ Dichaeta furcata Coq." The lectotype is deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., type number 6640. Coquillett's description also lists three male and two female syntypes from Biscayne Bay and Lake Worth, Florida. The type and type-locality, as indicated above, were subsequently designated by Cresson (1917).

DIAGNOSIS.—Although members of this species resemble those of *N. bispinosa,* they may be distinguished by the following combination of characters: First and second antennal segments black; third segment generally concolorous except for base, which in some specimens is yellowish; usually with more dorsal aristal branches, numbering 9–12; fourth and fifth abdominal terga of males *caudata*-like; fifth tergum extending posteriorly as a slender process which bears several, terminal bristles; large

bristles along posterior margin of fourth tergum more robust and numerous, numbering 11–13; terminalia unique, especially shape of hypandrial process and apical margin of epandrium (Figures 129–131).

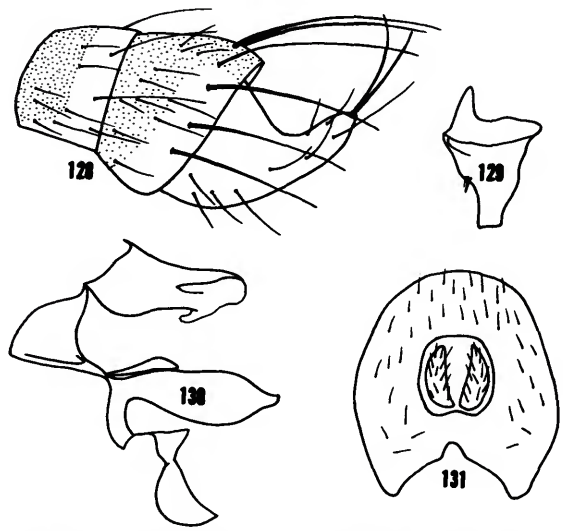
DESCRIPTION.—Moderately small to moderately large shore flies, length 2.80 to 4.1 mm; with light brown to gray coloration and some darker brown markings.

Head: Head ratio 1:0.70; postfrons ratio 1:0.56; coloration of frons quite uniform except for darker areas on either side of median triangular area. Paravertical bristle large, considerably larger than postocellars; 2 subequal, proclinate, fronto-orbital setae. First and second antennal segments dark; third segment often with pale, basal area, yellowish; 9–13 dorsal aristal branches. Face niveous; facial setae hairlike, extending dorsally two-thirds of facial height; prefrons ratio 1:0.73. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.18; gena narrow, cinereous; genal bristle subequal to paravertical bristle. Maxillary palpus pale, wide, yellowish orange.

Thorax: Mesonotum light brown, with some light, vittate markings; mesopleuron generally unicolorous, but with a slight brown marking; pleural areas gray. Femora and tibiae grayish black except for pale yellowish apices; all tarsi yellowish orange. Setal fascicle of hind basitarsus pale, entirely yellow. Wing ratio 1:0.46; costal vein ratio 1:0.44; M_{1+2} vein ratio 1:0.88.

Abdomen: Abdomen ratio 1:0.61; length of fourth tergum to fifth tergum ratio of males 1:0.75; fifth tergum ratio of males 1:0.56. Brown fascia distinct, posterior edge well demarcated from gray background color, continuing onto lateral margins and ventral surface. Large bristles along posterior margin of fourth tergum of males stout and long, numbering 11–13; fifth tergum produced posteriorly into a slender process with apical bristles and more slender bristles along its lateral sides. Male terminalia distinctive, see Figures 129–131.

SPECIMENS EXAMINED (237).—ALABAMA: Mobile Co., Codell (USNM). DELAWARE: Sussex Co,, Rehoboth (ANSP, USNM). FLORIDA: Hibernia (KU); Middle Cape-Cape Sable (CNC); Royal Palm Park (ANSP, KU, MCZ, USNM); Broward Co., Fort Lauderdale (MCZ), Hollywood (KU); Charlotte Co., Punta Gorda (FSCA); Collier Co., Everglades (ANSP, CNC, USNM); Dade Co., Everglades National Park (CNC, FSCA, KSU), Dodge Island (USNM), Biscayne Bay (AMNH, ANSP, FSCA, USNM), Miami (AMNH, UMN, USNM), 48.3 km N Miami (KSU), 40.3 km W Miami (KU), Big Pine Key (FSCA, KSU, USNM), Paradise Key (ANSP, CNC, MCZ, USNM), Key Largo (FSCA); Duval Co., Ortega River near Jacksonville (FSCA); Gulf Co., McNeil's (UMI), Port Saint Joe (UMI); Highlands Co. (USNM), Lake Placid (KU), Sebring (FSCA); Jefferson Co., Lloyd (MCZ); Martin Co., Jupiter Island (FSCA); Monroe Co., Everglades National Park (FSCA), Flamingo (CNC), No Name Key (FSCA); Orange Co., Orlando (ANSP, USNM); Palm Beach Co., Lake Worth (USNM), South Bay (KU), West Palm Beach (KU), Palm Beach (USNM), Belle Glade (KU); Pinnellas Co., Saint Petersburg (ANSP); Saint Johns Co., Saint Augustine (ANSP, KU, MCZ); Swannee Co., Branford (KU). GEORGIA: Liberty Co., Saint Catherine Island (AMNH). LOUISIANA: Cameron Parish, Cameron (ANSP, OHSU); Orleans Parish, New Orleans (ANSP); Plaquemines Parish, Port Sulfur (KU, USNM); Saint Tammany Parish, Slidell (OHSU); Terrebonne Parish, Houma (USNM). MISSISSIPPI: Harrison Co., Gulfport (CU). SOUTH CAROLINA: Allendale Co., Fairfax (AMNH). TEXAS: Galveston Co., Galveston (ANSP, AMNH, USNM). Dickinson (ANSP); Orange Co., Orange (USNM). VIRGINIA: Accomack Co., Assateague Island-Tom's Cave and vicinity (CU).



FIGURES 128–131.—*N. furcata:* 128, abdomen, lateral aspect; 129, surstylus, lateral aspect; 130, internal male genitalia, lateral aspect; 131, epandrium, cerci, and epandrial processes, posterior aspect.

GEOGRAPHIC DISTRIBUTION (Figure 132).—*Notiphila furcata* occurs along the southern Atlantic Coast in North America from Delaware south and along the Gulf Coast. Collection dates are from 6 February to 17 December.

REMARKS.—The external structures of the male fourth and fifth abdominal segments closely re-

semble those of the *caudata* Group and evidence a close relationship between that group and the remaining species-groups of the sub-genus *Dichaeta*.

Like *N. bispinosa,* this species inhabits coastal estuaries. The details of its biology should be interesting; perhaps they will also reflect the morphological intermediacy of this species.

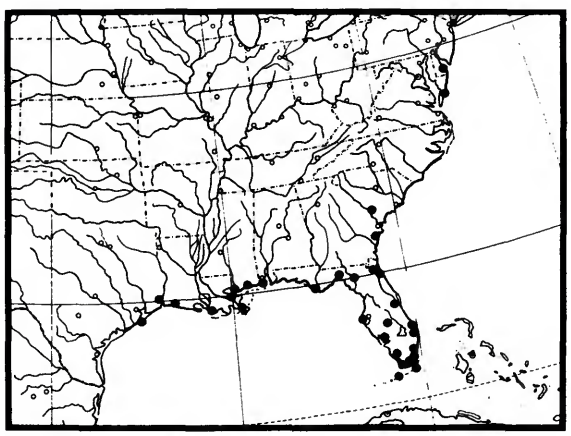


FIGURE 132.—*N. furcata:* distribution map.

The *caudata* Group

SPECIES INCLUDED.—*Notiphila atriventris* (Cresson), new combination; *N. caudata* Fallén; *N. transversa* Walker.

DIAGNOSIS.—General body coloration dark brown; abdominal terga mostly unicolorous, dark brown, frequently lacking distinct fascia; maxillary palpus pale, yellowish orange; antenna entirely dark brown or black; 2–3 large pairs of facial bristles, aligned parallel with parafacies near ventral facial margin; anterior proclinate, fronto-orbital seta distinctly larger, nearly equal in length to genal bristle; middle tibia with 3 erect bristles along dorsum, arranged 1.1.1.0; fifth tergum of male produced posteriorly, forming either a slender tube or less well-developed process, both terminating with 2–3 larger bristles; fourth tergum of males with markedly larger setae along posterior margin; ventral margin of epandrium produced ventrally, forming a broadly based, bluntly rounded, symmetrical process, but not of the type common to males of the subgenus *Notiphila;* frequently they accompany considerable flexion and curvature of the epandrium; surstyli large, somewhat triangular; hypandrial process long and slender, frequently with distinct sicklelike curvature apically; hypandrial receptacle apparently rudimentary. Larvae and pupae with long respiratory tube as described for the subgenus.

GEOGRAPHIC DISTRIBUTION.—The combined distribution of the Nearctic species of this group is widespread, ranging throughout North America except for the extreme Arctic regions.

DISCUSSION.—In the past, the species comprising this group were treated as the separate genus *Dichaeta.* Their reduced status here is the result of a careful reconsideration of the available evidence. The initial proposals of both *Notiphila* and *Dichaeta* were based only upon specimens from the palearctic fauna, and from that basis alone, their distinctiveness can hardly be questioned. Since then, however, two nearctic species have been discovered that link the species of *Dichaeta* with typical specimens of *Notiphila,* especially those of what was formerly the subgenus *Agrolimna.* The sister-group relationship between the *furcata* group (formerly *Agrolimna* in part) and the *caudata* group (*Dichaeta*) is amply confirmed by several synapotypes, most of which were used for recognizing *Dichaeta* as a separate genus. Accordingly, the continued recognition of *Dichaeta* as a distinct genus would leave *Notiphila* as a paraphyletic group, with several assemblages of at least equivalent cladistic ranking to *Dichaeta.* Consequently, I have reduced the members of *Dichaeta* to species-group status, but the name is retained as the senior synonym of the subgenus in place of *Agrolimna.* The evidence for these actions is detailed in the "Phylogeny and Classification" section.

Three named nearctic species are included in this group, although others, undescribed, are known to exist. A revision of this group is in progress and is intended to be part II of the present series.

The *scalaris* Group

SPECIES INCLUDED.—*Notiphila aenigma* Cresson; *N. atrata,* new species; *N. atripes* Cresson; *N. decoris* Williston; *N. deonieri,* new species; *N. deserta,* new species; *N. elophila,* new species; *N. macrochaeta* Loew; *N. minima* Cresson; *N. nanosoma,* new species; *N. olivacea* Cresson; *N. pallidipalpis* Cresson; *N. paludia,* new species; *N. quadrisetosa* Thomson; *N. scalaris* Loew; *N. sicca* Cresson; *N. uliginosa* Haliday.

DIAGNOSIS.—Generally body coloration gray to grayish brown, but with darker brown markings; abdominal terga fasciated, extent of fascia variable, sometimes covering most of tergum but usually with distinct posterior, lateral, and sometimes median margins; maxillary palpus dark, usually black; antenna usually entirely black, sometimes base of third segment with some pale coloration; facial setae small, hairlike, extending dorsally to at least midfacial height; 2 proclinate, fronto-orbital setae, subequal; middle tibia with 4 erect bristles along dorsum, arranged 1.1.1.1.; fourth and fifth tergum of male normally developed; ventral margin of epandrium of male terminalia not produced into a process; hypandrial process not as long or as slender as homologous structure in *pulchrifrons* group; surstyli subtriangular to subrectangular; hypandrial receptacle well sclerotized, bowl-shaped. Breathing tube of larvae and puparium long, equal to at least one-half body length minus length of breathing tube.

GEOGRAPHIC DISTRIBUTION.—Members of this group occur widely throughout North America, particularly in the West, where they are frequently abundant.

DISCUSSION.—The *scalaris* group, by far the largest species group of the subgenus, includes all but seven of the known species.

31. *Notiphila (Dichaeta) aenigma* Cresson

FIGURES 133–135

Notiphila (Agrolimna) olivacea var. *aenigma* Cresson, 1917:54.
Notiphila (Agrolimna) olivacea.—Cresson [in part], 1946:232.
Notiphila (Agrolimna) aenigma.—Wirth, 1965:747.

TYPE-MATERIAL.—Holotype male: "Seattle Washington, 15 July 1901/♂/HoloTYPE 6113/HoloTYPE Notiphila aenigma, E. T. Cresson Jr." The holotype is in the Academy of Natural Sciences of Philadelphia, type number 6113.

DIAGNOSIS.—Members of *N. aenigma* bear resemblances to those of *N. olivacea* but may be readily distinguished by the brown maculation on the mesopleuron and by the vittate mesonotum. The brown maculation pattern is subrectangular and extends from the prothoracic spiracle to the two larger bristles near the posterior margin of the mesopleuron. The vittate mesonotum is variable; I have examined specimens, generally poorly preserved, that bear little evidence of stripes. Most specimens, however, are conspicuously marked. Although very similar, the terminalia of *N. aenigma* males differ from that of *N. olivacea* males in the shape of the hypandrial process; the preapical swelling is more abruptly rounded; and the apical process is broader (Figures 133–134).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.46 to 4.53 mm; with light olive brown to brown coloration.

Head: Head ratio 1:0.73; mesofrons with median, light colored, tan, triangular area that extends posteriorly from broadly formed vertex at anterior margin of postfrons to vertex, including ocellar triangle; lateral margins of frons contrasting in coloration with mesofrons, darker, blackish brown; postfrons ratio 1:0.65. Two subequal proclinate, fronto-orbital setae; paravertical bristle large, slightly larger than genal bristles. Antennal segments dark, black, appearing pollinose; 9–13 dorsal aristal branches. Face grayish yellow; prefrons ratio 1:0.69; facial setae hairlike. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.19; gena gray. Maxillary palpus black.

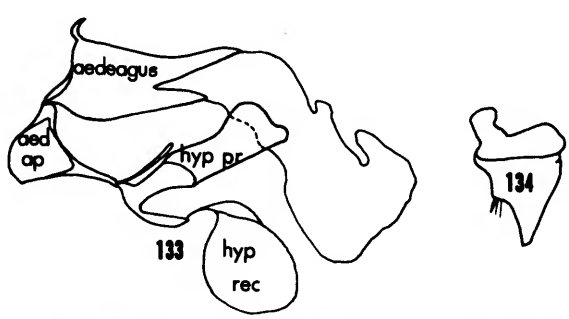
Thorax: Mesonotum darker than pleural areas, usually with median stripe and often with other vittate markings. Mesopleuron with brown, subrectangular maculation; pleural areas in general becoming lighter in color ventrally. Femora and tibiae more or less concolorous, grayish black; tarsi light grayish orange to subdued yellow; setal fascicle of hind basitarsus pale, yellowish orange. Wing ratio 1:0.46; costal vein ratio 1:0.5; M_{1+2} vein ratio 1:0.92.

Abdomen: Abdomen ratio of males 1:0.72; length of fourth tergum to fifth tergum of males 1:0.75; fifth tergum ratio of males 1:0.51. Third and fourth tergum with dark brown fascia along anterior margin that do not generally extend onto ventral surface; fifth tergum of males generally dark brown except for small, median, gray stripe and some lighter areas toward the anterolateral surfaces. Male terminalia as in diagnosis and in Figures 133–134.

SPECIMENS EXAMINED (413).—CANADA: ALBERTA: Wabamun (ANSP). BRITISH COLUMBIA: Hatzic Lake (CNC); Mission City (CNC); Royal Oak (ANSP). UNITED STATES: CALIFORNIA: Colusa Co., Colusa (UCB); Los Angeles Co., Long Beach, Los Angeles River (WSU); San Bernardino

Co., Redlands (ANSP); San Francisco Co., Lake Merced (CAS); San Luis Obispo Co., Pismo Beach (WSU). COLORADO: Boulder Co., Boulder (ANSP, CSU); Larimer Co., Ft. Collins (ANSP); Montezuma Co., 12.9 km W Cortez (WNM). IDAHO: Kootenai Co., Lake Cour d'Alene, 0.8 km E Harrison (WNM). MONTANA: Flathead Co., 1.6 km W Bigfork (KSU), 9.7 km NW Bigfork (KSU), 12.9 km NW Bigfork (KSU), 3.7 km E Bigfork (WNM); Lake Co., 8.1 km S Bigfork (KSU), 4.8 km E Polson (KSU), 6.4 km E Polson (KSU, WNM), 0.8 km SW Polson (KSU), 0.8 km S Ronan (KSU), 5.2 km S Ronan (WNM). NEVADA: Washoe Co., Reno (CAS), Sparks (CAS). NEW MEXICO: San Juan Co., 1.6 km S Bloomfield (WNM); San Miguel Co., 0.8 km NE Montezuma (WNM). OREGON: Benton Co., Finley Wildlife Refuge (WNM), McFadden Pond (WNM), Peavy Arboretum (WNM); Columbia Co., Clatskani (MSU); Coos Co., Hauser (WNM); Curry Co., Cape Blanco (WNM); Klamath Co., 4 km N highway 66 Brick Lake Road (WSU), Klamath National Forest Wildlife Refuge (WNM); Lake Co., Ana Reservoir (WNM); Lane Co. 9.7 km E Florence (WNM); Lincoln Co., Newport-Yaquina Bay (WNM); Tillamook Co., 3.6 km S Cloverdale (WNM). UTAH: Utah Co., Goshen Pond (WNM), Provo Environs (WNM); Wasatch Co., Heber (MSU); Weber Co., Plain City (ANSP). WASHINGTON: Franklin Co., 11.3 km WSW Eltopia (WNM); Grant Co. (WNM); Pierce Co., Lake Spanaway (WNM), Mount Rainier-Longmire (ANSP), 4.8 km WSW DuPont (WNM); San Juan Co., Orcas Island (ANSP), Mt. Constitution (ANSP), Friday Harbor (ANSP); Snohomish Co., Stanwood (ANSP, USNM); Whitman Co., Pullman (WSU); Yakima Co., Byron Ponds near Prosser (WSU).

GEOGRAPHIC DISTRIBUTION (Figure 135).—*Notiphila aenigma* was previously reported only from the state of Washington (Cresson, 1946; Wirth, 1965), but it has now been collected from most of the western United States and Canada. It occurs inland as commonly as on the coast. Collection dates are from 7 May to 1 September.



FIGURES 133–134.—*N. aenigma:* 133, internal male genitalia, lateral aspect (aed ap = aedeagal apodeme; hyp pr = hypandrial process; hyp rec = hypandrial receptacle); 134, surstylus, lateral aspect.

REMARKS.—Specimens of *N. aenigma* and those of its closely related congener, *N. olivacea,* often occur together. Because specimens of *N. aenigma* maintain their species integrity, as assessed from morphological evidence, in areas sympatric with specimens of *N. olivacea,* the status of this taxon as a valid species is clearly founded.

Busacca and Foote (1978) conducted extensive field and laboratory studies on this species in northeastern Ohio and northwestern Montana and much of the following has been paraphrased from their excellent work. They found that females oviposit on the inner surfaces of living and dead leaves of *Typha latifolia* that were bent over near the water's surface. Apparently each female matures two complements of eggs, those from newly-emerged females and a second batch several days later. Each female produced between 110 and 180 eggs. Based on laboratory rearings and estimates, Busacca and Foote gave the following timetable for development of immatures:

Egg: 1–4 days, most within 2 days
First larval instar: 2–5 days
Second larval instar: 4–8 days
Third larval instar: probably several months, overwintering stage
Pupae: 2–17 days (field collected, then reared)

Mature third-instar larvae developed bright yellow fat bodies behind the head and also attached

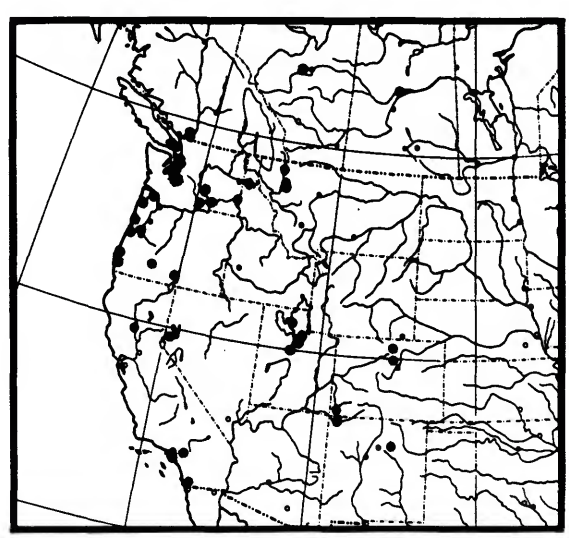


FIGURE 135.—*N. aenigma:* distribution map.

themselves firmly to rootlets shortly before forming puparia. Larvae and puparia were found associated or attached to the roots of *Typha latifolia,* but occasionally to those of *Scirpus validus.* Busacca and Foote discovered that almost all larvae fed free from the rootlets of *Typha* and attached only when additional oxygen is needed or as noted above just prior to forming the puparia. In Montana, *N. aenigma* apparently has one generation a year and overwinters as a mature larva.

I have collected third-instar larvae and puparia of *N. aenigma* along the West Coast from a stagnant pool on a landfill that extended into Newport Bay, Lincoln County, Oregon. Larvae and puparia were attached to the roots of *Scirpus maritimus* L. variety *paludosus* (A. Nels) Kuekenth, which were growing in a substrate of highly organic, black mud along the margins of the pool. The mud is probably similar to the black humus from which Berg (1950) collected the puparia of *N. loewi.*

The immature stages of *N. aenigma* appear almost identical to those of *N. quadrisetosa,* although they are slightly larger. The cephalopharyngeal skeletons of third-instar larvae of both species are very similar, and I cannot distinguish between the larvae and puparia of either species except by rearing and subsequent association. This species is also common in *Sparganium* bogs and in sedge-meadow and marsh-reed habitats.

32. *Notophila (Dichaeta) atrata,* new species

FIGURES 136–138

DIAGNOSIS.—Externally, members of *N. atrata* very closely resemble those of *N. quadrisetosa, N. nanosoma,* and *N. atripes.* Specimens appear to be most similar to those of *N. atripes* and have often been confused with this species. Specimens of *N. atrata* may be distinguished from related congeners by the following characters: Overall length generally longer than that of *N. nanosoma;* mesonotum bearing a median, posteriorly bifurcating stripe as in *N. quadrisetosa;* tarsi entirely dark, usually black; male genitalia distinctive, especially the shape of the hypandrial process and surstyli (Figures 136–138).

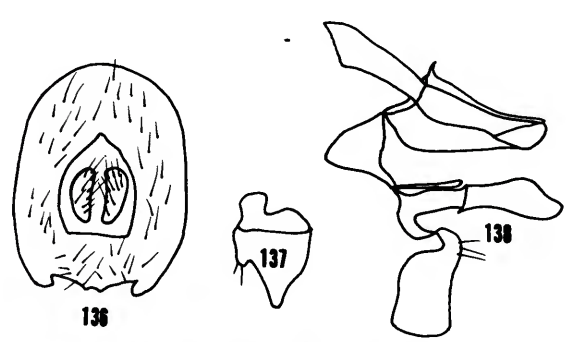
DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.86 to 3.40 mm; with grayish brown to olivaceous brown background coloration and dark brown to black markings.

Head: Head ratio 1:0.75; postfrons ratio 1:0.58; lateral margins and median triangular area of frons light grayish brown, generally concolorous; remainder of frons darker with charcoal tinges. Paravertical bristle moderately large, approximately twice length of postocellars; 2 pair of proclinate, fronto-orbital setae. Antennal segments entirely black; arista with approximately 10 dorsal branches. Face light yellow, pollinose, prefrons ratio 1:0.63; facial setae small, hairlike. Eye ratio 1:0.73; eye-to-cheek ratio 1:0.18. Genal bristle subequal to paravertical bristle; gena narrow, generally concolorous with face anteriorly, becoming grayer posteriorly. Maxillary palpus black.

Thorax: Mesonotum slightly darker than pleural areas and with a faint, median, posteriorly bifurcating stripe. Mesopleuron often with maculation area of darker color than surrounding color but not well defined. Legs mostly dark, usually entirely black. Setal fascicle of hind basitarsus amber. Wing ratio 1:0.40; costal vein ratio 1:0.58; M_{1+2} vein ratio 1:1.10.

Abdomen: Abdomen ratio of males 1:0.73; length of fourth tergum to fifth tergum ratio of males 1:0.95. Darkened fascia occupying most of abdominal terga 3 through 5, usually only with gray median stripe. Male terminalia as in Figures 136–138.

TYPE MATERIAL.—Holotype male: "Arizona White Mt. Res. E. of McNary 8 July 1940/Gertsch and Hook Acc. 37656/HOLOTYPE Notiphila atrata Mathis." Allotype female: "White River,



FIGURES 136–138.—*N. atrata:* 136, epandrium, cerci, and epandrial process, posterior aspect; 137, surstylus, lateral aspect; 138, internal male genitalia, lateral aspect.

Ar(izona), VI-19-1950, L. D. Beamer (KU)." Other paratypes as follows: 2♂, 1♀, White Mts. Ar., VI-19-1950, L. D. Beamer (KU, USNM); 4♂, 1♀, New Mexico, Jemez Springs, 4 July 1953; W. W. Wirth Collector (USNM). The holotype will be deposited in the American Museum of Natural History.

ETYMOLOGY.—The Latin adjective *atrata* ("dressed in black") refers to the generally dark coloration of this species.

GEOGRAPHIC DISTRIBUTION.—*Notiphila atrata* occurs in the mountainous areas of western New Mexico and eastern Arizona. This distribution is sympatric with that of *N. minima* and *N. atripes*. Collection dates are from 19 June to 8 July.

33. *Notiphila (Dichaeta) atripes* Cresson

FIGURES 139–143

Notiphila (Agrolimna) atripes Cresson, 1917:50.

TYPE-MATERIAL.—Holotype male: "15-6-(18)76 Beverly. Mass(achusetts). Burgess (collector?)/♂/ Type No. 20726 U.S.N.M. (red)/Holo-TYPE Notiphila atripes E. T. Cresson Jr (red)." The original description also listed two female paratopotypes.

DIAGNOSIS.—Externally, members of *N. atripes* are quite similar to those of *N. quadrisetosa* and *N. uliginosa*, and they have often been confused with both of the latter species. Specimens of *N. atripes* may be distinguished from these and other congeners by the following characters: Antenna, maxillary palpus, and legs entirely black; mesonotum and mesopleuron usually immaculate but exceptions with vittate markings; fascia of abdominal terga dark brown to black, usually extensive, often covering entire dorsum of fourth and fifth abdominal terga; ventral margin of hypandrial process sinuate; shape of preapical enlargement and surstyli distinctive (Figures 139–142).

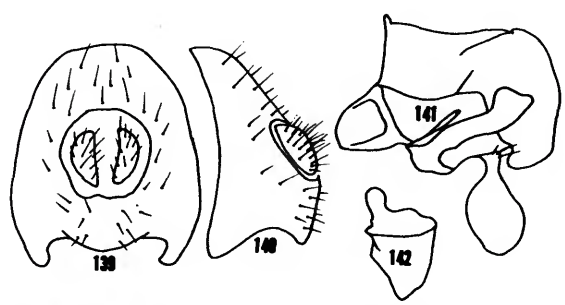
DESCRIPTION.—Moderately small to moderately large shore flies, length 2.56 to 4.10 mm; with light brownish gray to gray coloration and dark brown to black markings.

Head: Head ratio 1:0.73; postfrons ratio 1:0.56; frons with median triangular area and lateral margins concolorous but not too distinct from remainder of frons; extreme anterolateral margins in some specimens light gray. Paravertical bristle just slightly larger than biggest postocellar bristles; 2 pair of proclinate, fronto-orbital setae. Antennal segments entirely black; arista with 8–12 dorsal branches. Face yellowish gray; prefrons ratio 1:0.64; facial setae small, hairlike. Eye ratio 1:0.81; eye-to-cheek ratio 1:0.20; gena narrow, gray except for anterior portion, which is concolorous with face; genal bristle distinct. Maxillary palpus black.

Thorax: Generally unicolorous, mostly gray, although mesonotum is usually darker, brownish gray. Mesonotum and mesopleuron immaculate. Legs entirely dark, usually black although hind tarsomeres paler, yellowish in a few specimens; setal fascicle of hind basitarsus pale, amber. Wing ratio 1:0.43; costal vein ratio 1:0.57; M_{1+2} vein ratio 1:1.1.

Abdomen: Abdomen ratio of males 1:0.79; length of fourth tergum to fifth tergum ratio of males 1:1.4; fifth tergum ratio of males 1:0.56. Fascia of abdominal terga dark brown to black, distinctly contrasting with background coloration, especially on third and fourth terga; sometimes entire tergum of fourth and fifth segments is unicolorous, dark brown to black. Terminalia of males as in diagnosis and Figures 139–142.

SPECIMENS EXAMINED (1120).—CANADA: ALBERTA: Carmangay-Little Bow River (USNM); Sheep River (USNM); Banff (CNC, CAS); Jasper (CNC); Kannanakis (CAS); Scandia (CNC). BRITISH COLUMBIA: Clinton (CNC). MANITOBA: Birtle (AMNH); Warkwork Creek, near Churchill (CNC); Whitewater Lake (CNC). NORTHWEST TERRITORIES: Norman Wells (CNC). NOVA SCOTIA: Baddeck-Cape Breton (MCZ); English Town-Cape Breton (MCZ); Loua-Cape Breton Island (MCZ); Saint Ann-Cape Breton Island (MCZ); Petite Riviere (CNC). ONTARIO: Ottawa (ANSP, CNC). QUEBEC: Gaspe (AMNH, USNM);



FIGURES 139–142.—*N. atripes:* 139, epandrium, cerci, and epandrial process, posterior aspect; 140, same, lateral aspect; 141, internal male genitalia, lateral aspect; 142, surstylus, lateral aspect.

Gaspe-Anse Au Griffon (ANSP, USNM); Montreal (AMNH). SASKATCHEWAN: Attons Lake-Cut Knife (CNC); Lisieuz (CNC); Val Marie (CNC). YUKON TERRITORY: Whitehorse (CNC). UNITED STATES: CALIFORNIA: Eldorado Co., Fallen Leaf (CNC); Inyo Co., Bishop (KU), Death Valley Floor near Furnace Creek (ANSP), Deep Springs (UCB); Lassen Co., 35.4 km NW Susanville (WNM); Mariposa Co., Yosemite National Park (KU); Modoc Co., Alturas (WNM); Mono Co., 30.6 km NW Benton (WNM), Convict Creek (UCB, USNM), Fales Hot Spring (USNM), Mono Lake (USNM, WNM), 3.2 km N Mono (WNM); Nevada Co., Hobart Mills near Sage Hen (UCD), 4 km NW Hobart Mills (WNM); Placer Co., Lake Tahoe (USNM); San Luis Obispo Co., Alamo Creek (UCB); Shasta Co., Moose Camp (UCD); Trinity Co., Trinity River Camp (UCD); Tulare Co., 24.2 km NE California Hot Springs (WNM). COLORADO: Lindland (ANSP, CSU, WSU); Shaffers Crossing (ANSP, CSU); Boulder Co., Nederland (CNC, KU); Chaffee Co., Buena Vista (CNC), Poncha Springs (ANSP, CSU); Clear Creek Co., Idaho Springs (CSU); Dolores Co., 10.5 km W Dove Creek (WNM); Gilpin Co., East Portal (CNC); Hinsdale Co. (KU); Jackson Co., Gould (USU), Walden (USU); Jefferson Co., Golden (USNM); Lake Co., Tennessee Pass (KSU); La Plata Co., Electra Lake (WNM), Hesperus (WMN); Larimer Co., Fort Collins (ANSP, CSU, WSU), La Porte (CSU), Virginia Dale (MSU, USNM); Mesa Co., Glade Park (USNM); Montezuma Co., 12.9 km W Cortez (WNM); Park Co., Fairplay (WSU), Hartsel (USNM); Pitkin Co. (KNSU); Teller Co., Florissant (CAS); Weld Co., Roggen (WSU). IDAHO: Big Lost River-Salmon River Road Pass (ANSP). IOWA: Dickinson Co., Excelsior Fen (ISU); Polk Co., Clive (USNM). MASSACHUSETTS: Essex Co., Beverly (ANSP, USNM). MICHIGAN: Midland Co. (ANSP, MSU). MINNESOTA: Polk Co. (UMN). MONTANA: Flathead Co., 1.6 km W Bigfork (KSU), 3.2 km Bigfork (KSU), NW Bigfork (KSU), 16.1 km NW Bigfork (KSU); Glacier Co., 3.2 km E Babb (KSU, USNM), 37 km E Babb (KSU), NW Browning (KSU); Lake Co., 4.8 km E Polson (KSU), 6.4 km E Polson (KSU, USNM), 12.9 km NE Polson (USNM); Powell Co., Deer Lodge and vicinity (CU). NEBRASKA: Blaine Co., Dunning (MSU); Box Butte Co., Alliance (UN); Dawes Co., Marsland (UN, USNM); Morrill Co., Bayard (UN, USNM); Sheridan Co. (MSU). NEVADA: Elko Co., Wells (ANSP, CSU); Washoe Co., Reno (CAS). NEW MEXICO: Catron Co., 51.5 km E Glenwood (WNM); Otero Co., Cloudcroft (KU, USNM); Sandoval Co., Seven Springs Ranger Station (WNM), 17.7 km SE Cuba (WNM), 12.1 km N Jemez Springs (WNM); San Miguel Co., 0.8 km NE Montezuma (WNM). OREGON: Deschutes Co., 4.8 km SE La Pine (WNM); Grant Co., 0.8 km S Seneca (WNM); Harney Co., 3.2 km E Burns (WNM), 25.8 km N Burns (WNM), Denio (USNM); Josephine Co., 6.4 km W Selma (WNM); Klamath Co., Wood River Spring (WSU); Lake Co., Hart Mountain Refuge-Hot Spring Camp (WNM), Ana Reservoir (WNM), Hunter Hot Spring (WNM). 7.7 km N Summer Lake (WNM), Warner Canyon (WNM), 31.9 km NW Paisley (WNM), NW shore Alkali Lake (WNM); Union Co., North Powder (KU). SOUTH DAKOTA: Lake Oakwood (ANSP); Bennett Co., Martin (ANSP); Custer Co., Custer (ANSP), 11.3 km W Custer (WNM); Lawrence Co., 1.6 km W Savoy (WNM), 3.2 km W Savoy (WNM); Lincoln Co., Canton (ANSP); Tripp Co., Winner (ANSP). UTAH: Allen Canyon (CNC); Gooseberry (ISU); Sawtooth (ISU); Soldier Springs (UMN); Willow Creek Canyon (KU, UMN); Beaver Co., Beaver (UMN); Box Elder Co., Mantua (ISU); Carbon Co., Soldier Canyon (WNM), S Price (WNM); Cache Co., Logan (UMN), Logan Canyon (CNC, USU), Blacksmith Fork (USU), Richmond (UMN), Trenton (UMN); Duchesne Co., Indian Canyon (CU), Ashley National Forest-Lime Kiln Spring (WNM), 8.1 km N Mountain Home (WNM), Hana (UMN); Emery Co., 0.8 km N Castle Dale (WNM); Piute Co., Marysvale (CSU); Rich Co., Garden City (USNM), Laketown (ISU); Sevier Co., Salina (ISU); Uinta Co., Big Brush Creek, 35.4 km N Vernal (CNC); Utah Co., Provo (UNM); Wasatch Co., Strawberry Reservoir (CNC, KU, UNM), 3.2 km S Daniels Pass (CNC); Washington Co., Leeds (UMN), Saint George (UMN). WASHINGTON: Stevens Co., 24.2 km W Kettle Falls (USNM). WISCONSIN: Dodge Co., Beaver Dam (ANSP). WYOMING: Washakie (MSU); Albany Co., Tie Siding (USNM); Laramie Co., Horse Creek (KU); Niobrara Co., 19.3 km NW Lusk (KU); Teton Co., Hoback (MSU); Uinta Co., 1.6 km NW Evanston (KSU, USNM); Yellowstone National Park, south entrance (UCB), Beach Springs (ANSP, USNM), Twin Lakes (USNM).

GEOGRAPHIC DISTRIBUTION (Figure 143).—*Notiphila atripes* occurs widely in the West from the Yukon Territory south to southern New Mexico. In the Midwest and East, it is more restricted to the southern Canadian provinces and northern states of the United States. Collection dates are from 5 June to 4 August.

REMARKS.—Size variation among specimens of *N. atripes* is considerable and care must be exercised in distinguished between larger specimens of this species and those of *N. quadrisetosa*. Where both of these species occur together, separation is quite easy, but in allopatric situations, reference to the characters of the male terminalia is often necessary. In the Southwest, this species has been confused with *N. atrata*, which is very similar except for the median, mesonotal stripe and the shape of the hypandrial process. Like specimens of *N. atrata*, those of *N. atripes* are collected more often in mountainous environments. This species has been collected in sedge-meadow habitats associated with both lotic and lentic aquatic systems.

34. *Notiphila (Dichaeta) decoris* Williston

FIGURES 144–148

Notiphila decoris Williston, 1893:258.

Notiphila (Agrolimna) atrisetis Cresson, 1917:52. [New synonym.]

Notiphila (Agrolimna) decoris.—Wirth, 1965:747.

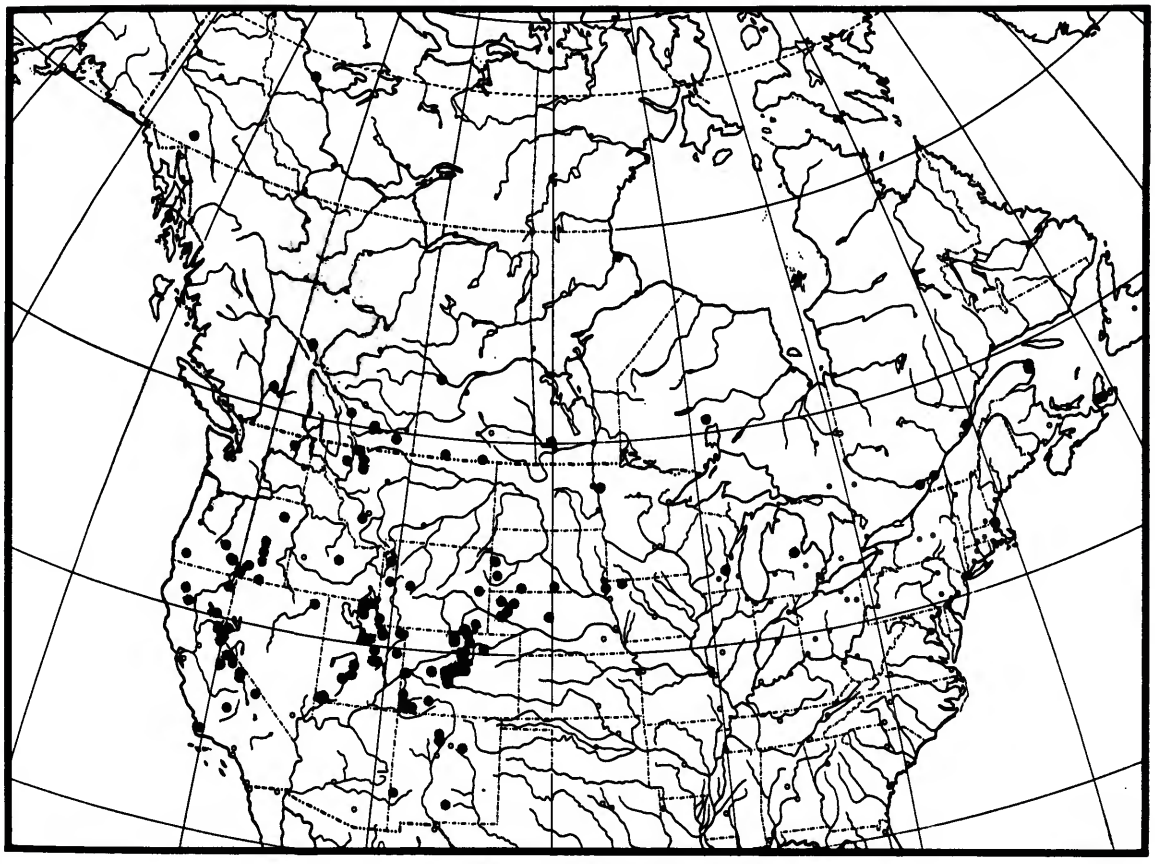


FIGURE 143.—*N. atripes:* distribution map.

TYPE-MATERIAL.—Holotype female: "Panamint V(alle)y., April (18)98 (1891) K./Through C. V. Riley/TYPE, Notiphila decoris Will. (red)." The holotype is in the Snow Entomological Museum, University of Kansas, Lawrence, type number 688. The holotype of the junior synonym is deposited with the Academy of Natural Sciences of Philadelphia, type number 6115, and bears the following label data: "Desert edge, San Diego Co., Cal(ifornia). 17 April 1915, M C VanDuzee/HoloTYPE 6115/ Holo-TYPE male, Notiphila atrisetis, E. T. Cresson Jr."

DIAGNOSIS.—Specimens of this species may be distinguished from others of the subgenus *Dichaeta* by the following combination of characters: Setal fascicle of hind basitarsus with 1 dark brown to black seta, this less than one-sixth length of basitarsal segment; front tarsomeres usually dark brown to black; mesopleuron only slightly discolored dorsally, without well-defined spot. Females of *N. decoris* could be confused with those of *N. macrochaeta* but the posteromedial area of the fifth abdominal tergum is normally sclerotized, similar to the rest of the tergum. The genitalia of *N. decoris* males are also distinctive (Figures 144–147).

DESCRIPTION.—Moderately small to large shore flies, length 2.94 to 5.54 mm; with gray to light brown coloration and dark brown markings.

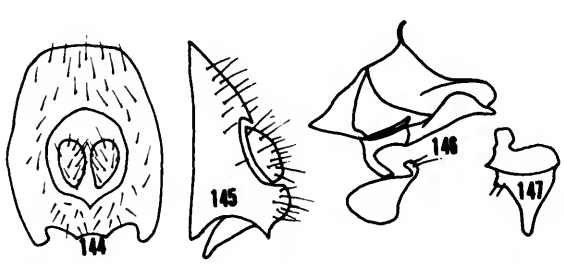
Head: Head ratio 1:0.70; lateral margins of frons usually gray, often concolorous with median triangular area; triangular area sometimes brownish gray, pollinose; most of mesofrons subdued charcoal black, usually lightly pollinose; postfrons ratio 1:0.53; paravertical bristle subequal to genal bristle. Antennal segments entirely black; 9–11 dorsal aristal branches. Face usually grayish yellow to

yellow; prefrons ratio 1:0.75; facial setae small, hairlike. Eye ratio 1:0.80; eye-to-cheek ratio 1:0.22; genal area becoming more grayed posteriorly; genal bristle prominent. Maxillary palpus black.

Thorax: Mesonotum lightly vittate; usually darker in color than pleural areas; mesopleuron without a definite maculation spot although some specimens have some discoloration along dorsal margin. Femora and tibiae grayish black to black; front tarsomeres usually dark brown to black, sometimes lighter in color; middle and hind tarsi yellowish orange to orange. Setal fascicle of hind basitarsus with a single, small, dark brown to black seta. Wing ratio 1:0.46; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:1.

Abdomen: Abdominal ratio of males 1:0.72; fourth tergum to fifth tergum length ratio of males 1:0.72; fifth tergum ratio 1:0.56. Fascia of abdominal segments dark brown, well defined, contrasting with grayer ground color. Male terminalia as in Figures 144–147.

SPECIMENS EXAMINED (1172).—CANADA: ALBERTA (ANSP). MANITOBA: Clear Lake-Riding Mountain National Park (CNC). UNITED STATES: ARIZONA: Apache Co., 1.6 km W Eagar (USU); Pima Co., Organ Pipe Cactus National Monument (USNM), Quinto Baquito (USNM). CALIFORNIA: Pine Lake (USNM); Alameda Co., Albany (UCB), Alvarado (CAS), Sunol (UCB); Alpine Co., Ebbets Pass (AMNH); Butte Co., Biggs (USNM); Calaveras Co., Milton (USNM); Colusa Co., Colusa (UCB, USNM), Maxwell (UCB, USNM); El Dorado Co., Echo Lake (KU), Pino Grande (UCB); Fresno Co., Coalinga (AMNH); Humboldt Co., Orick (ANSP, USNM), Trinidad (ANSP, USNM); Imperial Co., Calipatria (ANSP, USNM), Palo Verde (UCB, USNM); Inyo Co., Antelope Springs (UCB), Ballarat (UCB, USNM), Bishop (KU), Death Valley Floor near Furnace Creek (ANSP), Deep Springs (UCR), Little Lake (CAS, KU), Lone Pine (KU, USNM), Olancha (CAS), Panamint Springs (CNC, KU), Tecopa Hot Springs (WNM), Warm Sulphur Spring (UCR, USNM); Kern Co., Onyx (KU, USNM); Lake Co., Clear Lake (USNM), Lower Lake-Clear Lake (CAS); Lassen Co., 66 km NW Susanville (WNM); Los Angeles Co., Lancaster (MCZ), Los Angeles (MCZ), Palmdale (MCZ); Modoc Co., 6.4 km W Alturas (WNM), Canby (USNM), Lake City (UCD), Likely (USNM), Lookout (WNM), Surprise Valley (UCB); Mono Co., Benton (UMN), Convict Creek (USNM), Crooked Creek (UCB), Hot Creek (CAS), Mammoth Lakes (KU, USNM), Mono Lake (KU, UCB), 3.2 km N Mono Lake (WNM); Monterey Co., Asilomar (USNM); Napa Co., Knoxville (USNM), Pope Creek, 8.1 km NW Monticello (CAS), Samuel Spring (USNM); Nevada Co., near Hobart Mills (UCD), 1.6 km NW Hobart Mills (WNM); Orange Co., Laguna Beach (USNM); Riverside Co., Coachella (CAS), Riverside (ANSP), San Jacinto (CAS); San Bernardino Co., Jenks Lake (USNM), Morongo Valley (USNM), Needles (CU, USNM), Trona (CNC), Victorville (USNM); San Diego Co., Borego (UCB), Desert Edge (CAS), Jacumba Spring (ANSP, USNM), Russian River-Mesa Grande (ANSP); San Joaquin Co., Stockton (CAS); San Luis Obispo Co., Harmony (AMNH, USNM), Oso Flaco Lake (USNM); Santa Barbara Co., Carpinteria (WSU); Santa Clara Co., San Antonio Valley (UCB); Shasta Co., Cassel (UCB), Gibson (UCB, USNM); Siskiyou Co., Big Springs Wildlife Refuge (USNM), Bray area (UCR), Gazelle (MCZ), Shasta River, 2.1 km E Grenada (UCR); Stanislaus Co., Del Puerto Canyon (UCB, USNM); Tehama Co., 0.8 km S Corning (WNM); Tulare Co., Three Rivers (KU, USNM), Visalia (USNM); Tuolumne Co., Cathedral Canyon (USNM); Ventura Co., Port Hueneme (UCB); Yolo Co., Davis (ANSP, UCD, USNM), Putah Canyon (UCD, USNM), Woodland (UCD, USNM). COLORADO: Crowley Co., Crowley (ANSP, CSU, WSU); Pueblo Co., Pueblo (CSU); Weld Co., Roggen (ANSP). IDAHO: Canyon Co., Caldwell (ANSP); Gooding Co., Hagerman (USNM); Payette Co., Payette (MCZ). MONTANA: Lake Co., 4.8 km E Polson (KSU), 6.4 km E Polson (WNM); Madison Co., Madison Junction (USNM). NEBRASKA: Lincoln Co., Wellfleet (USU); Thurston Co., 12.9 km ENE Winnebago along Missouri River (ISU). NEVADA: Eastgate (USNM); Churchill Co., Fallon (USNM), Hazen (USNM), Soda Lake near Hazen (ANSP); Humboldt Co., Winnemucca Lake (USNM); Lander Co., 40.3 km N Austin (AMNH); Lyon Co., Fernley (ANSP, CSU, WSU); Nye Co., Beatty (USNM), 2.6 km S Springdale (AMNH); Washoe Co., Gerlach (CAS), Pyramid Lake (CAS), Steamboat (USNM). NEW MEXICO: McKinley Co., Zuni Salt Lake (USNM); Otero Co., White Sands National Monument (WSU); San Juan Co., 1.6 km S Bloomfield (WNM); Socorro Co., Socorro (ANSP, KU, USNM). OREGON: Benton Co., Finley Wildlife Refuge (WNM); Deschutes Co., Paulina Lake (WNM); Grant Co., John Day Gorge (CAS), 0.8 km S Seneca (WNM); Harney Co. (USNM), 14.5 km N Andrews (WNM), 8.1 km NE Fields (WNM), Harney Lake (USNM), Harney Hot Spring (CAS, USNM, WNM), hot spring in desert N of State hwy 78 and 13.5 km E Lawen (CU), W Whitehorse Ranch-Willow Creek (WNM); Jackson Co., Little Squaw Lake (WNM); Klamath Co., Bly (WSU), Deming Creek-Reservoir NE Bly (WSU); Lake Co., Ana Reservoir (WNM), NW shore Alkali Lake (WNM), Goose Lake State Park (CU),



FIGURES 144–147.—*N. decoris:* 144, epandrium, cerci, and epandrial process, posterior aspect; 145, same, lateral aspect; 146, internal male genitalia, lateral aspect; 147, surstylus, lateral aspect.

Hunter Hot Spring (WNM), Lakeview Hot Spring (WNM), 6.9 km NW Paisley (WNM), Summer Lake (WNM); Lane Co., 12.9 km S Florence (WNM); Malheur Co., 12.9 km N Andrew (WNM), 24.2 km NW Vale, margin of hot spring (WNM); Morrow Co., 3.2 km N Irrigon (WNM); Umatilla Co., Cold Springs (WSU). TEXAS: Lubbock Co., Buffalo-Spring Lake (USNM). UTAH: Flux (ANSP, USNM); Taylor (USU); Box Elder Co., Bear River Refuge (ISU), Blue Creek (USU), Collinston (UMN), Kelton (USU), Kosmo (USU), Locomotive Springs (USU), Snowville (USU); Cache Co., Benson (USU), Providence (USU); Carbon Co., Price (KU, WNM); Emery Co., 0.8 km N Castle Dale (WNM); Grand Co., Moab (ISU, USU); Rich Co., Woodruff (ANSP); Salt Lake Co., Garfield (ANSP, USNM), Great Salt Lake (ANSP, CAS), Saltair (USNM); San Juan Co., Bluff (USU); Sevier Co., Monroe (USU); Uintah Co., Vernal Canyon-Uinta Mountains (ANSP); Utah Co., Goshen (KU), Goshen pond (WNM), Hobble Creek (KU), Colton (ISU), Lakeshore (ISU), Utah Lake near Lehi (USNM), E shore Utah Lake (WNM), Spanish Fork (KU); Weber Co., Odgen (USU). WASHINGTON: Lind Lake (WSU); Clark Co., Lacamas Lake (ANSP, USNM): Franklin Co., 11.3 km WSW Eltopia (WNM), Kahlotus Lake (WSU), 3.2 km E Pasco (WNM), Scooteney Reservoir-Recreational Area (WNM); Grant Co., Bank Lake (WNM), O'Sullivan Dam (WSU); Okanogan Co., Brewster (USNM); Whitman Co., Almota (USNM); Yakima Co., Yakima (CAS), Byron Ponds near Prosser (WSU). WYOMING: Yellowstone National Park: Old Faithful (ANSP, USNM), U-Geyser Basin (ANSP, USNM), West Thumb (MCZ), White Dome Geyser vicinity (CU).

GEOGRAPHIC DISTRIBUTION (Figure 148).—*Notiphila decoris* occurs mainly west of the 100th parallel in North America. I have examined specimens from as far north as Manitoba (Clear Lake-Riding Mountain National Park) and southward into Mexico. Collection dates are from 31 March to 9 November.

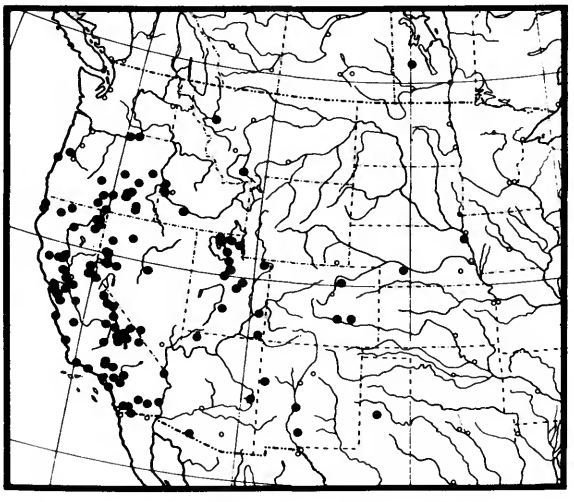


FIGURE 148.—*N. decoris:* distribution map.

REMARKS.—Specimens of *N. decoris* are among the most variable in size and color of the subgenus *Dichaeta*. Typically, specimens are very similar to those of *N. macrochaeta* and both species often occur sympatrically. Specimens of these species frequently have a dusted-white appearance, especially the anterior margin of the frons. The male genitalia are also quite similar. Larger specimens are sometimes confused with *N. olivacea,* being browner and approximately the same size, but the darkened bristles of the setal fascicle of the hind basitarsus is diagnostic for specimens of *N. decoris*. Specimens of *N. decoris* are often abundant, particularly around the littoral zone of ponds, stock watering holes, etc. They are also common in habitats where the water is alkaline or where the water source is a hot spring.

Although the type of the senior synonym is a female specimen, it was easily identifiable.

35. *Notiphila (Dichaeta) deonieri,* new species

FIGURES 149–151

DIAGNOSIS.—Specimens of *N. deonieri* are most similar to those of *N. olivacea* and based on external characters alone, I cannot consistently separate them. Usually the frons of *N. deonieri* specimens is browner and often the median stripe of the abdominal fascia extends to near the posterior margin of each tergum. In both of the above characters, however, there is considerable overlap with specimens of *N. olivacea*. The male genitalia are distinctive and may be used to identify this species: Preapical enlargement of hypandrial process almost pointed dorsally and not as homologous structure in *N. olivacea* (Figures 149–151).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.55 to 4.58 mm; with brownish gray coloration and brown markings.

Head: Head ratio 1:0.72; postfrons ratio 1:0.65; frons generally light brown, pollinose; median triangular area and lateral margins concolorous, lighter than remainder of frons, gray. Paravertical bristle much larger than postocellar setae; 2 pair of proclinate, fronto-orbital setae. Antenna entirely black; arista with 10–13 dorsal branches. Face grayish yellow, pollinose; prefrons ratio 1:0.71; facial

setae small, hairlike. Eye ratio 1:0.77; eye-to-cheek ratio 1:0.20; gena narrow with distinct bristle, subequal to paravertical bristle; gena gray except for anterior margin, which is concolorous with face. Maxillary palpus black.

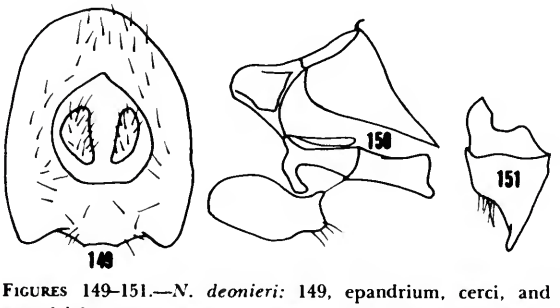
Thorax: Dorsum slightly darker than pleural areas; mesonotum immaculate; mesopleuron usually with brown, undefined spot near dorsal edge. Femora and tibiae grayish black; tarsi generally yellow, front tarsomeres and in some cases the middle tarsomeres darker, brownish yellow. Setal fascicle of hind basitarsus pale. Wing ratio 1:0.41; costal vein ratio 1:0.36; M_{1+2} vein ratio 1:0.80.

Abdomen: Abdomen ratio of males 1:0.70; length of fourth tergum to fifth tergum ratio of males 1:0.73; fifth tergum ratio of males 1:0.51. Fascia brown; on third and fourth terga the median stripe often reaching posterior margin of tergum, otherwise posterior margin gray, contrasting with darker fascia. Male terminalia as in Figures 149–151.

TYPE-MATERIAL.—Holotype male: "Goose Lake, Hamilton Co., Iowa VIII-14-1966, D. L. Deonier/ HOLOTYPE Notiphila deonieri Mathis (red)." Allotype and 11 paratypes (6♂, 5♀): with same label data as the holotype. The holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73542.

ETYMOLOGY.—The genitive patronym *deonieri* honors the collector of the type-series, Dr. D. L. Deonier, who has contributed substantially to our knowledge of the Nearctic Ephydridae with his revision of *Hydrellia* Robineau-Desvoidy.

GEOGRAPHIC DISTRIBUTION.—The type-locality, Goose Lake, Hamilton Co., Iowa, is the only site where this species has been collected.



FIGURES 149–151.—*N. deonieri:* 149, epandrium, cerci, and epandrial process, posterior aspect; 150, internal male genitalia, lateral aspect; 151, surstylus, lateral aspect.

REMARKS.—Specimens of *N. deonieri* are generally recognizable only after examining the structures of the male genitalia. The species occurs sympatrically with *N. olivacea,* its most closely related congener, and maintains its species identity.

36. *Notiphila (Dichaeta) deserta,* new species

FIGURES 152–154

DIAGNOSIS.—Superficially, specimens of *N. deserta* resemble those of *N. decoris,* as evidenced by a single, normally-developed, darkened seta of the setal fascicle of the hind basitarsus. Otherwise, specimens of *N. deserta* appear to be more similar to those of *N. pallidipalpis* or to *N. sicca.* The latter associations are especially evident in the structural similarities of the male terminalia. However, *N. deserta* members may be distinguished from all congeners of the subgenus by the following combination of characters: Maxillary palpus and antenna entirely black; mesopleuron usually with a darkened maculation area toward dorsal margin; mesonotum more or less immaculate although a few specimens with some very light, vittate markings; setal fascicle of the hind basitarsus with 1 darkened seta; and fascia of abdominal terga well defined, brown, but not extending on ventral surfaces. The hypandrial process of *N. deserta* males is quite similar to the homologous structure of *N. sicca* males, but the shape of the surstyli, especially the apices, differs considerably in both species. The resemblance of the genitalia of *N. deserta* males with those of *N. pallidipalpis* is even closer but after close comparison, they can be seen to consistently differ in several respects (Figures 152–154).

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.54 to 4.40 mm; with light brownish gray coloration and brown markings.

Head: Head ratio 1:0.72; postfrons ratio 1:0.60; lateral margins and median triangular area of frons concolorous; remainder of frons subdued, charcoal black, lightly pollinose; para-vertical bristle much larger than postocellar setae, subequal to genal bristle; 2 pair of proclinate, fronto-orbital setae. Antenna entirely black; arista with 9–11 dorsal branches. Face light grayish yellow; prefrons ratio 1:0.81; facial setae hairlike, usually not numbering more than 6 or 7. Eye ratio 1:0.75;

eye-to-cheek ratio 1:0.21; genal bristle distinct; gena concolorous with face anteriorly, becoming gray posteriorly. Maxillary palpus black.

Thorax: Thorax in general unicolorous although mesonotum slightly darker; some specimens with light, vittate markings on mesonotum. Mesopleuron usually with a brownish maculation area; pleural areas brownish gray, becoming grayer posteriorly and ventrally. Femora and tibiae grayish black; tarsi pale, usually yellow; front tarsomeres sometimes lightly tinged with one darkened seta of normal length. Wing ratio 1:0.37; costal vein ratio 1:0.37; M_{1+2} vein ratio 1:0.85.

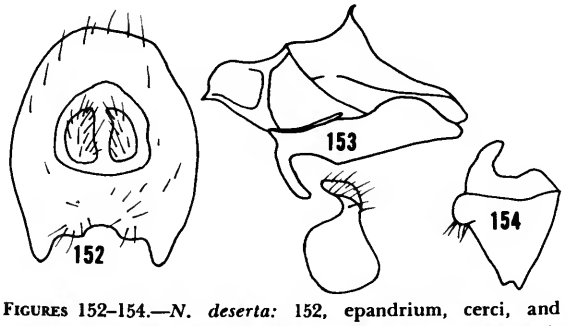
Abdomen: Abdomen ratio of males 1:0.63; length of fourth tergum to fifth tergum ratio of males 1:0.76; fifth tergum ratio of males 1:0.54. Background color of abdominal terga concolorous with thoracic pleural areas; fascia brown, well defined, especially posteriorly but not extending on ventral surface. Male terminalia as in Figures 152–154.

TYPE-MATERIAL.—Holotype male: "N(ew). MEX(ico): San Juan Co 1 mi [1.6 km] S Bloomfield 25 June 1973 Wayne N. Mathis/HOLOTYPE Notiphila deserta Mathis (red)." Twenty-three paratypes (allotype female, 5♂, 17♀): with same locality data as the holotype. Other paratypes as follows: 1♂, 1♀, New Mexico, San Miguel Co., 0.8 km NE Montezuma, 26 June 1973, Wayne N. Mathis; 1♀, Utah, San Juan Co., 3.2 km S Blanding, 23 June 1973, Wayne N. Mathis. The holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., type number 73543.

ETYMOLOGY.—The Latin adjective *deserta,* ("abandoned" or "waste") alludes to the habitat of the primary type-series.

GEOGRAPHIC DISTRIBUTION.—Specimens of *N. deserta* have been collected from two sites in northern New Mexico and from one site in southeastern Utah.

REMARKS.—This species has always been found sympatrically with other *Notiphila* species. Specimens were collected from grass-sedge habitats along the flood plains of the San Juan and Galinas Rivers in New Mexico. A single female was swept from emergent vegetation associated with a pond in southern Utah.



FIGURES 152–154.—*N. deserta:* 152, epandrium, cerci, and epandrial process, posterior aspect; 153, internal male genitalia, lateral aspect; 154, surstylus, lateral aspect.

37. *Notiphila (Dichaeta) elophila,* new species

FIGURES 155–156

DIAGNOSIS.—Although specimens of this species closely resemble those of *N. olivacea* and *N. uliginosa,* they may be distinguished from either by the following combination of characters: With only 5–7 dorsal aristal branches; paravertical bristle very large, approximately twice the length of postocellar setae; The genitalia of the male are as in Figures 155–156 and demonstrate a close relationship between this species and its similar congeners mentioned above. The surstyli do not have a secondary lobe as in *N. uliginosa* males and the shape of the hypandrial process distinguish *N. elophila* from any other.

DESCRIPTION.—Moderately large shore flies, length approximately 4.5 mm (taken from the allotype); with light brown to grayish brown coloration and some darker brown markings.

Head: Head ratio 1:0.74; postfrons ratio 1:0.61; median triangular area and lateral margins of frons concolorous, slightly lighter than remainder of frons, pollinose, light brown; remainder of frons with some charcoal tinges. Paravertical bristle very large, equal or slightly more than twice the length of postocellar setae; 2 pair of proclinate, fronto-orbital setae. Antennal segments entirely dark, black; arista with 5–7 dorsal branches. Face golden brown; facial setae long, numbering 5–7; prefrons ratio 1:0.69. Eye ratio 1:0.69; eye-to-cheek ratio 1:0.19. Gena fairly narrow, generally concolorous with facial color anteriorly, becoming grayer posteriorly; genal bristle subequal to paravertical

bristle or slightly smaller. Maxillary palpus dark, black.

Thorax: Mesonotum light brown with some brownish gold pollenosity posteriorly, anteriorly grayer, immaculate, darker than pleural areas. Mesopleuron with faint darker area but without definite maculation spot. Femora and tibiae generally concolorous, dark, with extensive gray dusted areas, apically pale; tarsi generally pale, front tarsomeres slightly darker. Setal fascicle of hind basitarsus pale. Wing ratio 1:0.40; costal vein ratio 1:0.53; M_{1+2} vein ratio 1:0.93.

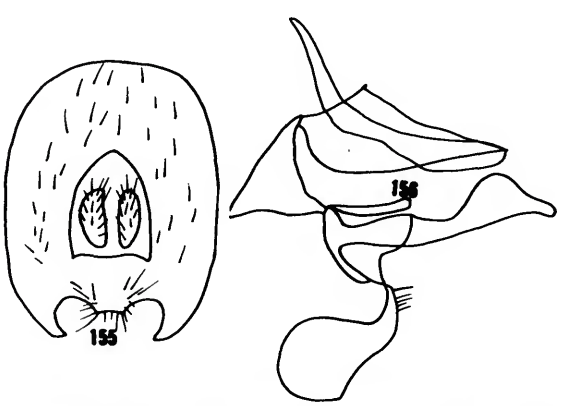
Abdomen: Generally as in *N. uliginosa.* Male genitalia as in diagnosis and Figures 155–156.

TYPE-MATERIAL.—Holotype male: "River head Long Island New York 4 July 1952, Roy Latham/ HOLOTYPE Notiphila elophila Mathis (red)." Allotype female: "Montauk Long Island New York, 4 September 1953, Roy Latham." The holotype and allotype will be deposited with the National Museum of Natural History, Smithsonian Institution, Washington, D. C., type number 73544.

ETYMOLOGY.—*Elophila,* of Greek derivation, is a combination of the nouns *elo* ("marsh") plus *philia* ("love") in allusion to the habitat of this species.

GEOGRAPHIC DISTRIBUTION.—The few localities of the type-series, as given above, are the only sites where this species has been collected.

REMARKS.—This species occurs sympatrically with *N. olivacea.* Nothing is known regarding its biology.



FIGURES 155–156.—*N. elophila:* 155, epandrium, cerci, and epandrial process, posterior aspect; 156, internal male genitalia, lateral aspect.

38. *Notiphila (Dichaeta) macrochaeta* Loew

FIGURES 157–161

Notiphila macrochaeta Loew, 1878:192.
Notiphila (Agrolimna) macrochaeta.—Cresson, 1917:54.
Notiphila (Agrolimna) macrochaeta brachychaeta Cresson, 1946:232. [Synonymy by Wirth, 1965:747.]

TYPE-MATERIAL.—Holotype male: "Texas Left. (?) (green)/Loew Coll./macrochaeta n. sn./Type 11131/Notiphila macrochaeta Lw, det. W. Wirth '61." The holotype is in the Museum of Comparative Zoology, Harvard University, type number 11131. The type of *N. macrochaeta brachychaeta* is deposited with the Academy of Natural Sciences of Philadelphia, type number 6673; it bears the following label data: "Pacific Grove, June Cal(ifornia). W. H. Mann/1285/TYPE 6673 Notiphila macrochaeta brachychaeta Cresson TYPE."

DIAGNOSIS.—Specimens of this species are very similar to those of *N. decoris,* especially females, but may be distinguished by the following characters: Setal fascicle of hind basitarsus with 1 black seta that is over one-third length of basitarsal segment in males; black seta of female specimens not enlarged. Females may be separated from those of *N. decoris* by the membranous posteromedial areas of the fifth abdominal tergum.

DESCRIPTION.—Moderately small to moderately large shore flies, length 2.80 to 4.15 mm; with subdued grayish brown to gray coloration.

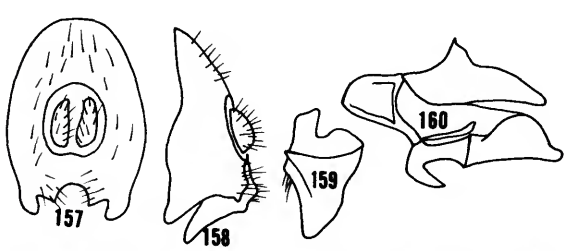
Head: Head ratio 1:0.71; postfrons ratio 1:0.56; frons generally subdued, often the anterior margin overcast with grayish silver coloration; lateral margins of frons or less concolorous with median triangular areas, rest of frons blackish. Paravertical bristle subequal to postocellar setae; 2 pair of proclinate, fronto-orbital setae. Antenna entirely black; arista with 8–10 dorsal branches. Face usually golden yellow, pollinose, prefrons ratio 1:0.71; facial setae hairlike. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.18. Gena becoming grayish white posteriorly, genal bristle distinct. Maxillary palpus black.

Thorax: Generally unicolorous, mesonotum slightly darker; mesonotum vittate although not pronounced; mesopleuron without any maculation spot or slightly discolored. Femora and tibiae grayish black; tarsi yellowish orange except front tarsomeres which are darkened, tinged with some char-

coal coloration. Setal fascicle of hind basitarsus with 1 black seta, in males seta over one-third length of basitarsal segment. Wing ratio 1:0.46; costal vein ratio 1:0.49; M_{1+2} vein ratio 1:1.1.

Abdomen: Ground color generally concolorous with thorax; fascia contrasting, well defined, and dark brown but not continuing on ventral surface. Abdominal ratio of males 1:0.76; length of fourth tergum to fifth tergum ratio of males 1:1.1; fifth tergum ratio 1:0.59. Male terminalia as in Figures 157–160.

SPECIMENS EXAMINED (1347).—CANADA: MANITOBA: Whitewater Lake—6.4 km N Whitewater (CNC). UNITED STATES: ARIZONA: Cochise Co., 20.9 km E Douglas (UCD), Chiricahua Mountains (KU), Herb Martyr Dam (FSCA, KSU, WNM), John Hand Park (FSCA), 8.1 km W Portal-Southwest Research Station (CAS), Elfrida (UA), Sunnyside Canyon-Huachuca Mountains (USNM); Coconino Co., Bill Williams Forest (KU), Oak Creek Canyon-Sedona (USNM); Maricopa Co., Tempe (ISU); Pima Co. (US), Santa Cruz River (UA); Gila Co., 8.1 km N Payson-Verde River (WNM); Yavapai Co., Montezuma-Well National Monument (USNM). ARKANSAS: Washington Co., (USNM). CALIFORNIA: Ortega Highway (USNM); Alameda Co., Berkeley (CAS); Butte Co., Chico (USNM); Contra Costa Co., Antioch (UCR); Fresno Co., 5.6 km NE Piedra (UCR); Humboldt Co., Mad River Beach (UCB); Inyo Co., Deep Springs (UCD, UCR, USNM), Crooked Creek Laboratory; White Mountains (UCB), One Pine (KU), Owens River (CU), Shoshone (USNM); Kern Co., S Inlet-Lake Isabella (UCR), Rosamond (KU, USNM), Onyx (KU); Los Angeles Co., Inglewood-Ingleside (CU), Los Angeles River (ANSP); Marin Co., 22.7 km NW Olema (UCB), Mill Valley (CAS); Modoc Co., Lake City (UCD, USNM); Mono Co., 3.2 km N Mono Lake (WNM); Monterey Co., Asilomar (USNM), Del Monte (USNM), Pacific Grove (USNM), Marina (CAS), Monterey (AMNH), Cala (AMNH); Napa Co., Knoxville (UCD); Nevada Co., 8.1 NW Hobart Mills (UNM); Orange Co., Buena Park (USNM), Capistrano-hot springs (USNM), Laguna Beach (CAS, UCB); Riverside Co., Riverside (ANSP, USNM), Temecula (UCB, UCD, UCR, USNM), Vail Lake-Temecula (UCR); San Bernardina Co., Redlands (USNM); San Diego Co., Desert edge (CAS), 40.3 km N Ensenada (USNM), Escondido (USNM), Julian (UCD, USNM), La Jolla (CAS, KU), Lake Henshaw Dam (UCR), Mesa Grande-Russian River (ANSP), Solana Beach (CAS); San Luis Obispo Co., Harmony (AMNH, USNM), Morro Bay (USNM), Oso Flaco Lake (UCB, UCR, USNM), San Simeon (AMNH, USNM); Santa Barbara Co., Carpinteria (USNM); Santa Clara Co., Stanford (ANSP, CAS, USNM); San Antonio Valley (UCB); Santa Cruz Co., 12.9 km S Grenada (WNM); Solano Co., Rio Vista (USNM), 0.8 km E Pittman Road-Cordelia Road (CU); Sutter Co., Live Oak Park (USNM); Tulare Co., 35.4 km N California Hot Spring (WNM), E Success Reservoir (UCR, USNM), Three Rivers (KU), Visalia (ANSP, USNM), Woodlake (USNM); Yolo Co., Putah Canyon (UCD). COLORADO: Baca Co., 45.1 km S Walsh (WSU); Clear Creek Co., Doolittle Ranch-Mount Evans (CNC), Echo Lake-Mount Evans (CNC), Chicago Creek-Mount Evans (CNC); Dolores Co., 10.5 km W Dove Creek (WNM); El Paso Co. (KNSU); Lake Co., Independence Pass (CNC); Larimer Co., Fort Collins (CSU); Mesa Co., Grand Junction (KU); Park Co., Kenosha Pass (CSU); Pueblo Co., Pueblo (ANSP). GEORGIA: Union Co., Neel Gap (USNM). IDAHO: Canyon Co., Caldwell (ANSP); Oneida Co., Curlew Valley Reservoir (USU). IOWA: Dickinson Co., Iowa Lakeside Laboratory (ISU), West Okoboji Lake (ISU); Fremont Co., Forney's Lake Public Hunting Area (ISU); Hamilton Co., Little Wall Lake (ISU, USNM); Story Co., Ames (CNC, ISU, USNM). KANSAS: Allen Co. (KU); Butler Co. (ANSP); Clay Co. (CU), Clay Center (UCR); Douglas Co. (KU), Lawrence (CNC, KU); Harper Co. (KU); Ottawa Co. (ANSP); Pottawatomie Co. (KNSU); Riley Co., Manhattan (KNSU); Seward Co., Liberal (KU). LOUISIANA: East Feliciana Parish, Clinton (ISU). MINNESOTA: Houston Co. (UMN); Olmstead Co., Rochester (KU); Saint Louis Co., Eaglesnest (USNM); Wabasha Co., Wabasha (UMN). MISSOURI: Barry Co., Roaring River State Park (CAS); Jackson Co., Atherton (ANSP); Laclede Co., Lebanon (USNM). MONTANA: Lake Co., 8.1 km S Swan Lake (KSU); Treasure Co., US Hwy 94 at rest stop ca. 43.5 km W Forsythe (CU). NEBRASKA: Chase Co., 16.1 km SW Imperial (USNM, UN); Cherry Co., Sargent (UN), Snake Falls (MSU, USNM); Dawson Co., Willow Island (UCD); Dixon Co., Allen (KSU); Grant Co., 4.8 km S Hyannis (UN); Holt Co. 38.6 km S Atkinson-Lierman Ranch (UN); Knox Co., 24.2 km NW Crofton-Lewis and Clark Lake (UN, USNM); Lancaster Co., Lincoln (UN), Hallan (USNM); Loup Co. (UN); Morrill Co. (MSU, USNM); Sioux Co., Andrews (UN). NEVADA: Carson City (KU, USNM); Churchill Co., Fallon (KU, USNM); Nye Co., 7.2 km N Beatty (WNM), 2.6 km S Springdale (AMNH); Washoe Co., Reno (USNM). NEW MEXICO: Catron Co., Apache Creek (WNM), Adam Hoague Lake (WNM); Dona Ana Co., Las Cruces (WNM); Grant Co., Mangus Springs, 17.7 km S Cliff (WNM); Hidalgo Co., 32.2 km S Rodeo (UCR); Otero Co., Alamogordo (KU); Sandoval Co., 12.1 km N Jemez Springs (WNM); San Miguel Co., 0.8 km NE Montezuma (WNM); Socorro Co., Magdalena (AMNH, FSCA), Socorro (ANSP); Torrance Co., Estancia (KU). OKLAHOMA: Alfalfa Co., Cherokee (AMNH). OREGON: Harney Co., Denio (USNM), 8.1 km NE Fields (WNM), hot springs in desert N of St Hwy 78



FIGURES 157–160—*N. macrochaeta*: 157, epandrium, cerci and epandrial process, posterior aspect; 158, same, lateral aspect; 159, surstylus, lateral aspect; 160, internal male genitalia, lateral aspect.

and 13.5 km E. Lawen (CU); Klamath Co., NE Bly-Deming Creek Reservoir (WSU); Lake Co., Ana Reservoir (WNM), NW shore Alkali Lake (WNM), Hunter Hot Spring (WNM), 31.9 km NW Paisley (WNM), Summer Lake (WNM), 7.7 km N Summer Lake (WNM); Morrow Co., 3.2 km N Irrigon (WNM); Union Co., Hot Lake (WNM). SOUTH DAKOTA: Brookings Co., Brookings (ANSP, USNM); Hand Co., Burdette (KU); Charles Mix Co., Lake Andes (ANSP); Stanley Co., Fort Pierre (ANSP); Todd Co., 24.2 km S Mission (ISU); Union Co., 8.1 km W Jefferson (ISU). TEXAS: Aransas Co., Aransas Refuge (USNM); Armstrong Co., Palo Duro State Park (USNM); Brazoria Co. (KU); Brooks Co. (KU); Cameron Co., Brownsville (CAS, USNM), Harlingen (USNM), Laguna Madre, 40.3 km SE Harlingen (ISU, USNM), San Benito (ISU); Calhoun Co., Port Lavaca (KNSU); Cherokii Co., Jacksonville (USNM); Dallas Co. (UNM); Galveston Co., Dickinson (ANSP), Galveston (AMNH, ANSP, KU, USNM); Gillespie Co., Pedernales River (USNM); Hays Co., San Marcos (USNM); Jackson Co., Edna (USNM); Jeff Davis Co., 37 km W Fort Davis (CNC); Jim Wells Co. (KU, USNM); Kenedy Co., Sarita (INHS); Kerr Co., Kerrville (CNC), 16.1 km S Kerrville (CAS), Henkes Pond near Kerrville (USNM); Kimble Co., Roosevelt (USNM); Lubbock Co., Buffalo Spring Lake (USNM); Sutton Co., (KU); Val Verde Co., Devil's River-Del Rio (CNC). UTAH: Box Elder Co., Blue Creek (USU), Brigham City (USU), Corinne (USU), Fielding (USU), Howell (USU); Cache Co., Amalga (USU), Logan (USU), Logan Canyon (ANSP, USU), Logan Dry Canyon (USU); Davis Co., Farmington (USNM), Syracuse (ANSP, USU), West Point (USU); Emery Co., Green River (UMN); Grand Co., Moab (USU, UMN); Iron Co., Parowan (USU); Rich Co., Randolph (ANSP); San Juan Co., 3.2 km S Blanding (WNM); Sevier Co., Monroe (ANSP), Sigurd (ANSP); Utah Co., Benjamin (UMN), Goshen Pond (WNM), Payson (UMN), Provo Environs (WMN), Spanish Fork (ISU, USU), E side Utah Lake (WNM); Washington Co., Leeds (UMN); Weber Co., Hooper (ANSP, USU), Ogden (USU). WASHINGTON: Franklin Co., 11.3 km WSW Eltopia (WNM), 3.2 km E Pasco (WNM); Grant Co., O'Sullivan Dam (WSU); Jefferson Co., Port Townsend (WSU); Yakima Co., Byron Ponds near Prosser (WSU).

GEOGRAPHIC DISTRIBUTION (Figure 161).—This species is widely distributed in North America west of the Mississippi River and into the Southeast as far as Georgia. I have examined many specimens from Mexico. Collection dates are from 25 January to 6 December.

REMARKS.—This species is not likely to be confused with any other of the subgenus *Dichaeta*

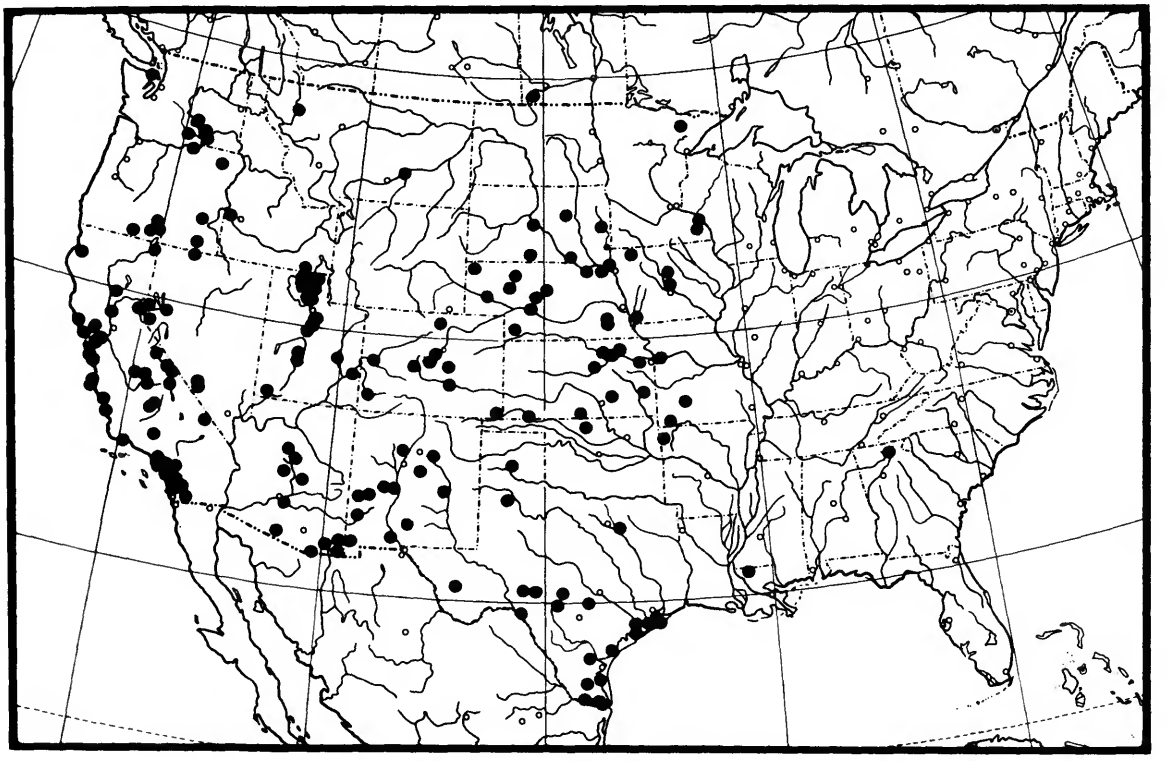


FIGURE 161.—*N. macrochaeta:* distribution map.

except possibly for *N. decoris*. The character states mentioned in the key and diagnosis should serve to adequately separate them, however.

Notiphila macrochaeta often occurs sympatrically with *N. decoris* and frequently with *N. olivacea*. Like *N. decoris*, it is usually associated with the littoral zone of lentic systems where some emergent vegetation exists. These areas usually have a higher percentage of grasses than sedges and the water level is quite seasonal, often drying up during the late summer. Specimens of *N. macrochaeta* have been collected at elevations of up to 12,000 feet in the Colorado Rockies.

39. *Notiphila (Dichaeta) minima* Cresson

FIGURES 162–164

Notiphila (*Agrolimna*) *occidentalis* var. *minima* Cresson, 1917:52.

Notiphila (*Agrolimna*) *occidentalis minima*.—Cresson, 1946: 233.

Notiphila (*Agrolimna*) *minima*.—Wirth, 1965:747.

TYPE MATERIAL.—Holotype male: "Jemez M(oun)t(ain)s. IX-10-(19)14 N(ew). M(exico)./♂/ Holo TYPE 6108/Holo-TYPE Notiphila minima, E. T. Cresson Jr." The holotype is in the Academy of Natural Sciences of Philadelphia, type number 6108. An additional male paratopotype is listed in Cresson's original description.

DIAGNOSIS.—Externally, *N. minima* specimens appear to be similar to those of *N. nanosoma* and *N. atripes*. Specimens may be distinguished from the latter by the following characters: Overall size small; legs not as dark as in specimens of *N. nanosoma;* aedeagal apodeme subtriangular, dorsal edge not rounded; hypandrial process with a small, prebasal swelling; preapical enlargement longer and more prominent than in males of *N. nanosoma* (Figures 162–163).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.62 to 3.25 mm; with brownish gray to gray coloration and black markings.

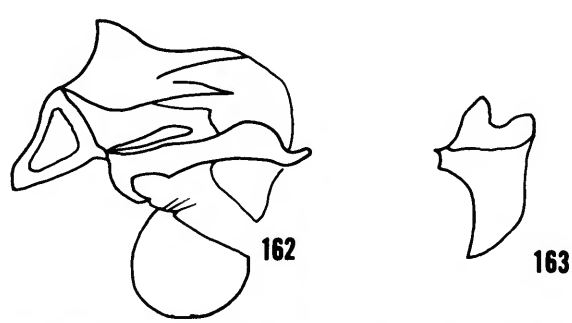
Head: Head ratio 1:0.68; postfrons ratio 1:0.55; lateral margins concolorous, with median triangular areas of frons brownish gray; remainder of frons subdued, black, somewhat pollinose. Paravertical bristle larger than postocellar setae, subequal to genal bristle; 2 pair of proclinate, fronto-orbital bristles. Antenna entirely black; arista with 8–10 dorsal branches. Face grayish yellow; prefrons ratio 1:0.54; facial setae hairlike. Eye ratio 1:0.83; eye-to-cheek ratio 1:0.13. Gena narrow, concolorous with face anteriorly, becoming grayish posteriorly; genal bristle subequal to paravertical bristle. Maxillary palpus black.

Thorax: Mesonotum and mesopleuron immaculate, light brownish gray, becoming grayer ventrally. Femora and tibiae concolorous, grayish black, front tarsomeres generally dark although in some specimens there is some yellow coloration; middle and hind tarsi yellow. Setal fascicle of hind basitarsus pale, yellow. Wing ratio 1:0.42; costal vein ratio 1:0.54; M_{1+2} vein ratio 1:1.20.

Abdomen: Abdomen ratio of males 1:0.62; length of fourth tergum to fifth tergum ratio of males 1:0.97; fifth tergum ratio of males 1.0.70. Fifth abdominal tergum entirely black; fourth tergum mostly black except for posterior margin; first, second, and third terga with considerable gray background color but third tergum also with black fascia along anterior margin. Male terminalia as in diagnosis and Figures 162–163.

SPECIMENS EXAMINED (130).—NEVADA: Nye Co., 2.6 km S Springdale (ANSP, USNM). NEW MEXICO: Catron Co., Apache Creek (WNM); Guadalupe Co., Santa Rosa (USU); San Juan Co., 1.6 km S Bloomfield (WMN); San Miguel Co., 0.8 km NE Montezuma (WNM); Sandoval Co., Jemez Springs Mts. (ANSP); Valencia Co., Belen (KU). UTAH: Iron Co., Parowan (UMN); Wasatch Co., Soldier Summit (UMN); Washington Co., Leeds (UMN, USNM).

GEOGRAPHIC DISTRIBUTION (Figure 164).—This species occurs in Nevada, New Mexico, and Utah. Collection dates are from 26 May to 8 August.



FIGURES 162–163.—*N. minima:* 162, internal male genitalia, lateral aspect; 163, surstylus, lateral aspect.

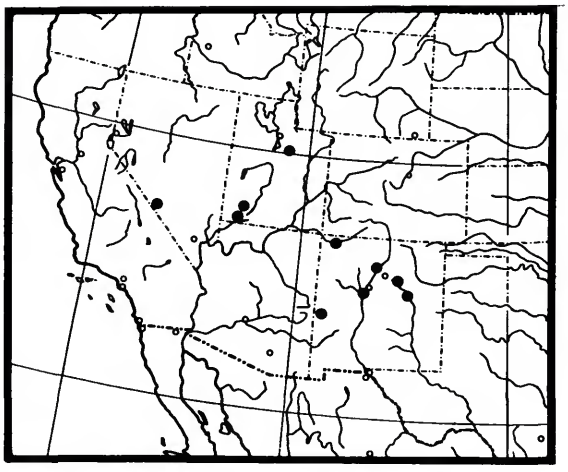


FIGURE 164.—*N. minima:* distribution map.

REMARKS.—Cresson (1917) proposed *N. minima* as a subspecies of *N. occidentalis* (=*N. quadrisetosa*), but in his later synopsis of the genus (1946) he synonymized it with the nominate species. Wirth (1965), however, recognized it as a full species, which is amply confirmed by differences in size, color, and structures of the male genitalia. This species is more closely related to *N. nanosoma* and *N. atripes* than to *N. quadrisetosa.*

40. *Notiphila (Dichaeta) nanosoma,* new species

FIGURES 1, 165–166

DIAGNOSIS.—Specimens of *N. nanosoma* resemble those of both *N. minima* and *N. atripes* but differ from either by the following combination of characters: Legs unicolorous, entirely black, except for setal fascicle of the hind basitarsus which is pale, amber; fascia of abdominal terga broad, especially on fourth and fifth terga where they cover most of the dorsum. Specimens of *N. nanosoma* are smaller on the average than members of *N. atripes* and the genitalia of *N. nanosoma* males are quite distinct: Hypandrial process broader and preapical enlargement not as extensive or prominent. Other differences in the male genitalia may be noted in the shapes of the aedeagal apodeme, which is rounded dorsally in *N. minima* males, and the surstyli (Figures 165–166).

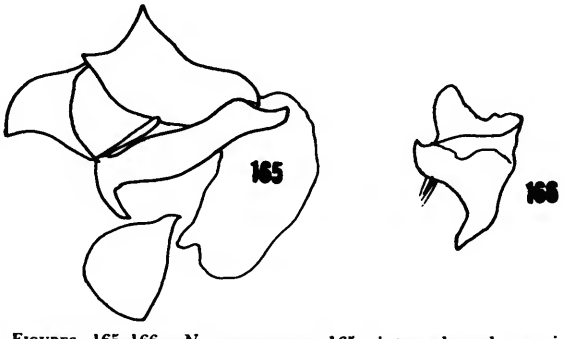
DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.56 to 3.46 mm; with grayish coloration and black markings.

Head: Head ratio 1:0.76; postfrons ratio 1:0.58; extreme lateral margin of frons whitish gray, otherwise most of lateral margins concolorous with median triangular area; remainder of frons subdued, black, lightly pollinose. Paravertical bristle slightly larger than postocellar setae; 2 pair of proclinate, fronto-orbital setae. Antenna entirely black; arista with 8–10 dorsal branches. Face light grayish yellow; prefrons ratio 1:0.56; facial setae small, hairlike. Eye ratio 1:0.80; eye-to-check ratio 1:0.16. Gena narrow, concolorous with face anteriorly, becoming gray posteriorly. Maxillary palpus black.

Thorax: Thorax light brownish gray, pleural areas grayer than mesonotum; mesopleuron and mesonotum immaculate although some specimens with very light, vittate markings on mesonotum. Legs entirely grayish black to black. Setal fascicle of hind basitarsus pale, amber. Wing ratio 1:0.42; costal ratio 1:0.60; M_{1+2} vein ratio 1:1.20.

Abdomen: Abdomen ratio of males 1:0.63; length of fourth tergum to fifth tergum ratio of males 1:1; fifth tergum ratio of males 1:0.61. Fascia of abdominal terga black; first and second terga mostly gray; third tergum approximately half and half; fourth tergum mostly black except for a median gray area; fifth segment entirely black. Male terminalia as in Figures 165–166.

TYPE-MATERIAL.—Holotype male: "CALIF(ornia) Nevada Co. 5 mi [8.1 km] NW Hobart Mill 20 June 1974 Wayne N. Mathis/HOLOTYPE Notiphila nanosoma Mathis (red)." Allotype female and 79 paratypes (41 ♂, 37 ♀): with same label data



FIGURES 165–166.—*N. nanosoma:* 165, internal male genitalia, lateral aspect; 166, surstylus, lateral aspect.

as the holotype. Other paratypes as follows: 3♂, 1♀, California, Nevada Co., 4 km NW Hobart Mills, 20 June 1974, Wayne N. Mathis (WNM); 10♂, 10♀, California, Nevada Co., Sagehen Creek, near Hobart Mills, dates: 20 June 1954, 25 June 1954, June 1954, 4 July 1962, 18 July 1967, collectors: M. T. James, R. H. Goodwin, C. A. Toschi, W. J. Turner (UCB, USNM, WSU); 9♂, 11♀, Oregon, Deschustes Co., 24.2 km S Sisters, 8 August 1973, 10 July 1972, Wayne N. Mathis (WNM). The holotype will be deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D. C., type number 73545.

ETYMOLOGY.—The epithet *nanosoma,* of Greek derivation, is a combination of the nouns *nanos* ("dwarf") plus *soma* ("body") in reference to the small body size.

GEOGRAPHIC DISTRIBUTION.—This species has been collected in the Sierra Nevada Mountains of California and in the Cascade Mountains of Oregon.

REMARKS.—I have collected specimens of this species from high-mountain, sedge-meadow habitats in Oregon and California. These habitats are fragile and very seasonal. In Oregon, specimens of *N. nanosoma* were collected only in July and August, and the specific collection site was limited to a small area of the total meadow where iron oxide had been leached from the soil and was floating on the water's surface. In California, *N. nanosoma* occurs sympatrically with *N. atripes* and *N. decoris.*

41. *Notiphila (Dichaeta) olivacea* Cresson

FIGURES 167–170

Notiphila (Agrolimna) olivacea Cresson 1917:52

TYPE-MATERIAL.—Holotype male: "Sandusky, Ohio, July, 1914." The holotype is deposited with the Ohio State University insect collection, Columbus. Cresson originally listed the type deposition as "Ohio Univ. Coll." This citation is either in error or the type was deposited in the Ohio State collection at a later date. Two male and six female paratopotypes were also listed in the original description.

DIAGNOSIS.—Specimens of *N. olivacea* closely resemble those of *N. deonieri, N. uliginosa, N. paludia, N. aenigma,* and *N. elophila.* The latter species are often confused with *N. olivacea* and in the case of *N. deonieri,* comparisons of the male genitalia are necessary to distinguish the species. *N. olivacea* members, however, can usually be distinguished from the others by the following combination of external characters: maxillary palpus and antenna entirely black; mesonotum and mesopleuron, although not immaculate, lacking well defined maculation patterns; front tarsomeres usually darkened, middle and hind tarsi plus setal fascicle of hind basitarsus pale, yellow; fascia of abdominal terga 3 and 4 usually distinct, contrasting with gray ground color along posterior margins; genitalia of males distinctive as in Figures 167–169.

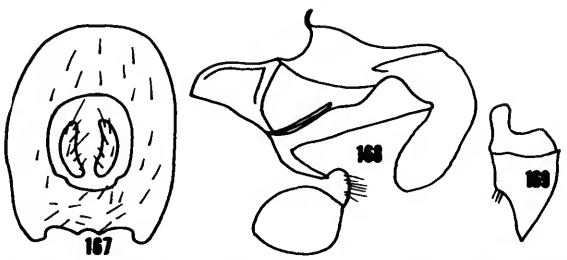
DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.35 to 4.5 mm; with light brownish gray to olive gray coloration and brown markings.

Heads Head ratio 1:0.72; postfrons ratio 1:0.64; frons with lateral margins and median triangular area concolorous, gray, pollinose; remainder of frons subdued black, also pollinose. Paravertical bristle larger than postocellar setae although the largest pair of latter bristles but slightly smaller; 2 pair of proclinate, fronto-orbital setae. Antenna entirely black; arista with 10–13 dorsal branches. Face pale, grayish yellow; prefrons ratio 1:0.72; facial setae numbering 7-9, small, hairlike. Eye ratio 1:0.74; eye-to-cheek ratio 1:0.19. Gena narrow, gray except for anterior portion, which is concolorous with face; genal bristles subequal to paravertical bristle. Maxillary palpus black.

Thorax: Mesonotum a little darker than pleural areas, brownish gray, immaculate, mesopleuron often with brown spot near dorsal edge but not subrectangular as in *N. aenigma* members. Legs, except for tarsi, grayish black, joints often pale; tarsi yellow, sometimes front tarsomeres darker with brown tinges. Setal fascicle of hind basitarsus pale, yellow. Wing ratio 1:0.43; costal vein ratio 1:0.38; M_{1+2} vein ratio 1:0.83.

Abdomen: Abdomen ratio of males 1:0.86; length of fourth tergum to fifth tergum ratio of males 1:1.3; fifth tergum ratio of males 1:0.70. Fascia of third, fourth and fifth terga brown; posterior margins of third and fourth terga gray, contrasting with brown fascia. Male terminalia as in Figures 167–169.

SPECIMENS EXAMINED (1213).—CANADA: Alberta: Banff (ANSP, CNC); Carmangay-Little Bow River (USNM); Gull Lake (ANSP); Tabe River (ANSP). BRITISH COLUMBIA: Kamloops-Alkali Lake (USNM); Keremeos (CNC); Hatzic Lake



FIGURES 167–169.—*N. olivacea:* 167, epandrium, cerci, and epandrial process, posterior aspect; 168, internal male genitalia, lateral aspect; 172, surstylus, lateral aspect.

(CNC); Nicola (CNC); Okanagan Falls (CNC); Oliver (ANSP, CNC); Sawmill Lake-Telegraph Creek (CNC). MANITOBA: Aweme E. (CNC); 3.2 km N Forest (CNC); 14.5 km N Forest Station (CNC); International Peace Gardens-Turtle Mountain Forest Reserve (CNC); Max Lake-Turtle Mountain Forest Reserve (CNC); Ninette (CNC); Scarth (CNC); 8.1 km SW Shilo (CNC); 6.4 km N. Whitewater-Whitewater Lake (CNC); Winnipeg-Beach (CNC). NEW BRUNSWICK: Glebe Road-Chamcook (CNC). NOVA SCOTIA: Lockeport (CNC). ONTARIO: Kent-Rondeau Park (ANSP, USNM); Long Point-Lake Erie (CNC); Marmora (CNC); Ottawa (ANSP, CNC); Ottawa River-Remic Rapids (CNC); Orilla (CNC); Perth Road (CNC); Point Pelee (CNC); Silver Creek (ANSP); Toronto (ANSP); Turkey Point (CNC). QUEBEC: L'Assomption (CNC); Montreal (AMNH); Norway Bay (CNC). SASKATCHEWAN: Christopher Lake (CNC); Indian Head (CNC). UNITED STATES: ALASKA: Anchorage-Fish Creek Flats (USNM). ARIZONA: Pima Co., Picture Rock Pass-Tucson Mountains (USU). CALIFORNIA: Upper Lake (FSCA); Alameda Co., Oakland (CAS); Inyo Co., 3.2 km N Cartago (USNM), Deep Springs (UCB, USNM); Kern Co., Kernville (KU); Modoc Co., 6.4 km W Alturas (WNM), Surprise Valley-dunes Fort Bidwell (UCB); Mono Co., W shore Mono Lake (WNM); Monterey Co., Carmel (USNM); Nevada Co., 1.6 km NW Hobart Mills (WNM); Riverside Co., Aguanga, 6.4 km W Riverside (USNM, UCD); San Bernardino Co., Boulder Bay-Big Bear Lake (UCR); San Diego Co., Campo (KU), Mission-Beach (KU); Santa Barbara Co., Carpinteria (USNM, WSU); Santa Clara Co., San Antonio Ranger Station (UCB); Sierra Co., Sierraville (UCB); Solano Co., Cordelia Road, 0.8 km E Pittman Road (CU). COLORADO: Boulder Co., Boulder (WSU); Clear Creek Co., Idaho Springs (ANSP, CSU, WSU); Dolores Co., 10.5 km W Dove Creek (WNM); Jefferson Co., Golden (USNM); Larimer Co., Fort Collins (ANSP, CSU, WSU); Mesa Co., Fruita (USNM); Mineral Co., Creede (ISU); Montezuma Co., 12.9 km W Cortez (WNM); Pueblo Co., Pueblo (ANSP); Weld Co., Roggen (ANSP, WSU). IDAHO: Caribou Co., Soda Springs, 1.6 km N (WNM); Cassia Co., Burley (KU); Fremont Co., Saint Anthony (USNM); Kootenia Co., Coeur d'Alene-Echo Bay (USNM), 0.8 km E. Harrison (WNM). Illinois: Cook Co., Chicago (USNM); Lake Co., Pistakee Bay (USNM); McHenry Co., McHenry (ANSP). IOWA: Boone Co., Ledges State Park (ISU); Guthrie Co., Springbrook State Park (ISU); Hamilton Co., Goose Lake (USNM), Little Wall Lake (ISU, USNM); Story Co., Ames (CNC), 6.4 km E Gilbert (ISU); Woodbury Co., Brown's Lake (ISU). KANSAS: Clark Co. (KU); Harvey Co., Newton (KU); Stafford Co. (ANSP). MASSACHUSETTS: Barnstable Co., Falmouth (USNM), Provincetown (ANSP), Woods Hole (USNM); Bristol Co., Hough-Horse Neck Beach (USNM), New Bedford (AMNH, FSCA); Dukes Co., Naushon (ANSP), Penikese Island (USNM); Nantucket Co., Nantucket (ANSP). MICHIGAN: Allegan Co., Douglas Lake (USNM); Alpena Co. (USNM); Arenac Co. (USNM); Bay Co. (ANSP, MSU, USNM); Houghton Co. (USNM); Iosco Co. (MSU); Mackinac Co. (MSU); Midland Co. (ANSP, MSU); Monroe Co., Monroe (ANSP, USNM); Muskegon Co. (MSU); Schoolcraft Co. (MSU); Wayne Co. (USNM), Detroit (ANSP, USNM), Grosse Ile (USNM). MINNESOTA: Marshall Co. (UMN); Roseau Co., Warroad (ANSP); Sibley Co., River near Blakeley (UMN). MONTANA: Flathead Co., 1.6 km W Bigfork (KSU, USNM), 3.2 km W Bigfork (KSU), 9.7 km NW Bigfork (KSU, USNM), 12.9 km NW Bigfork (KSU, USNM); Lake Co., 24.2 km S Bigfork (KSU), Black Lake, 3.2 km W Dayton (KSU), Dayton (ANSP), 4.8 km E Polson (KSU), 6.4 km E Polson (KSU, USNM), 4.8 km S Ronan (KSU), 5.2 km S Ronan (WNM). NEBRASKA: Dawson Co., Willow Island (UCD); Hall Co., Grand Island (UCD). NEVADA: Churchill Co., Soda Lakes near Hazen (USNM); Elko Co., Wells (USNM); Storey Co., Wadsworth (USNM); Washoe Co., Sparks (CAS). NEW JERSEY: Cape May Co., Cape May (ANSP); Essex Co., Newark (AMNH), W Orange (ANSP); Ocean Co., Manahawkin (ANSP). NEW MEXICO: Bernalillo Co., US 85, 4.8 km S Isleta (CU); Catron Co., Apache Creek (WNM); Otero Co., Cloudcroft (KU); San Juan Co., 1.6 km S Bloomfield (WNM); San Miguel Co., 0.8 km NE Montezuma (WNM). NEW YORK: Bronx (AMNH); Whiteface Mountain (CNC); Cayuga Co., N Fairhaven (CU); Eric Co., Elma (ANSP), Ton. Indian Reservation (CU); Genessee Co., Bergen (KU); Queens Co., Flushing (USNM); Rockland Co., Bear Mountain Bridge (USNM); Schoharie Co., Sharon Springs (ANSP); Suffolk Co., Babylon (USNM), Cold Spring Harbor (USNM); Thompkins Co., 2.4 km W Cardiff (CU), Ithaca (CU, UCR), Taughannock Falls (USNM); Wyoming Co., Portageville-Genessee River (USNM). NORTH DAKOTA: Benson Co., Broken Bone Lake (CU); Grand Forks Co., 91 m E junction US Hwy 2 and St Hwy 32 (CU). OHIO: Carroll Co. (KSU); Erie Co., Kelleys Island (OHSU), Sandusky (ANSP, OHSU); Portage Co., 7.2 km E Kent (KSU), 7.2 km NE Kent (KSU), 12.9 km SE Kent (KSU). OREGON: Beaver Marsh (UCB); Grant Co., 1.9 km S Seneca (WNM); Harney Co., Denio (USNM), Harvey Lake (USNM), S shore Harney Lake (WNM), Harney Hot Spring (WNM), Willow Creek, W Whitehorse Ranch (WNM); Lake Co., Ana Reservoir (WNM), NW shore Alkali Lake (WNM), Hunter Hot Springs (WNM), 6.9 km NW Paisley (WNM), 31.9 km NW Paisley (WNM), 7.7 km N Summer Lake (WNM), Warner Canyon (WNM); Malheur Co., Vale (USU); Morrow Co., 3.2 km N Irrigon (WNM); Umatilla Co., Hermiston (WNM); Wheeler Co., 29.8 km E Mitchell (WNM). SOUTH DAKOTA: Lake Oakwood (ANSP); Custer Co., 11.3 km W Custer (WNM); Fall River Co., Hot Springs (ANSP); Lawrence Co., Spearfish (ANSP); Union Co., Elk Point (ANSP). TEXAS: Buffalo Spring Lake (USNM); Lubbock Co., Lubbock (CSU). UTAH: Cache Co., Logan (UMN), Logan

Canyon (ANSP), Mendon (ANSP), Hyde Park (USU), Millville (KSU), Trenton (UMN); Carbon Co., Clear Creek Canyon (ISU), S Price (WNM); Duchesne Co., Duchesne (USU); Emery Co., 0.8 km N Castle Dale (WNM), Green River (ISU); Grand Co., Moab (ISU); Iron Co., Coal Creek (USU); Kane Co., Kanab (ISU), Kanab Creek Canyon (ISU); Millard Co., Filmore (UMN); Salt Lake Co., Salt Lake City (USNM), Sandy (USU); San Juan Co., 10.5 km N LaSal Junction (WNM); Sevier Co., 14.5 km E Cove Fort-Fish Lake National Forest (ISU), Richfield (ISU); Utah Co., Goshen (USU), Provo (UMN); Wasatch Co., Heber (USNM); Weber Co., Ogden (UMN), Ogden Canyon (ANSP, USU). WASHINGTON: Adams Co., Ritzville (USNM); Franklin Co., 11.3 km SWS Eltopia (WNM), Kahlotus Lake (WSU), Palouse Falls (WNM), 3.2 km E Pasco (WNM), Scooteney Recreational Area (WNM); Grant Co., Bank Lake (WNM), Coulee City (USNM), O'Sullivan Dam (WSU); King Co., Seattle (USNM); Lincoln Co., Sprague (USNM); Pierce Co., Fort Lewis-Sears Lake (CAS); Snohomish Co., Stanwood (USNM); Whitman Co., Pullman (WSU); Yakima Co., Byron Ponds near Prosser (WSU), Moxee (USNM). WYOMING: Niobrara Co., 19.3 km N Lusk (KU); Platte Co., Chugwater (ANSP); Yellowstone National Park, Riverside (ANSP, USNM).

GEOGRAPHIC DISTRIBUTION (Figure 170).—*Notiphila olivacea* is one of the most widely ranging species of the subgenus *Dichaeta,* occurring throughout North America except for the Southeast. Collection dates are from 12 April to 18 October.

REMARKS.—This species is similar to several members of the subgenus *Dichaeta* and in many cases, reference to the male genitalia is necessary to identify it. I have collected specimens of *N. olivacea*

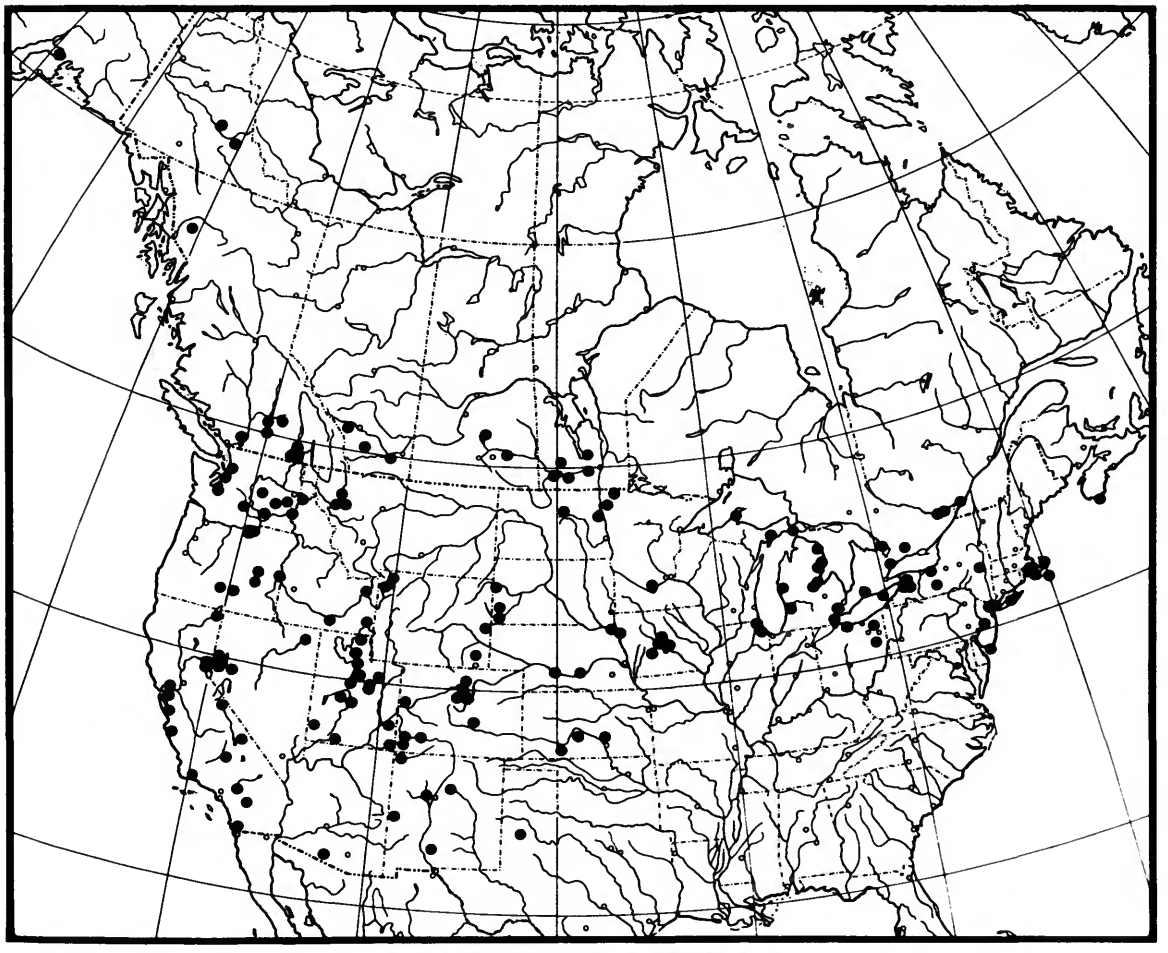


FIGURE 170.—*N. olivacea:* distribution map.

from freshwater situations but also along the margins of shallow, alkaline lakes in eastern Oregon where sedge-meadows are found. In the West, it commonly occurs sympatrically with *N. macrochaeta* and *N. decoris* and I have also found it with *N. aenigma*. Deonier collected a large series of both *N. olivacea* and *N. deonieri* from Goose Lake, Iowa.

42. *Notiphila (Dichaeta) pallidipalpis* Cresson

FIGURES 171–173

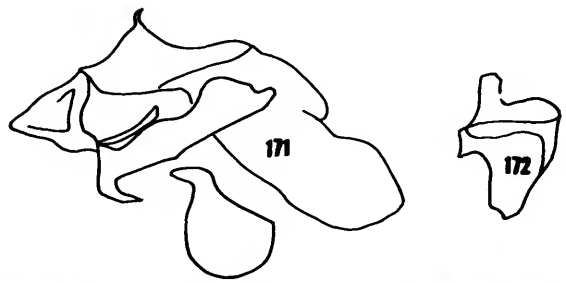
Notiphila pallidipalpis Cresson, 1940:8.
Notiphila (Agrolimna) pallidipalpis.—Cresson, 1946:223.

TYPE-MATERIAL.—Holotype male: "Isle Royale Mich(igan). Aug. 3–7, 1936, C. Sabrosky/TYPE 6544 Male Notiphila PALLIDIPALPIS, E. T. Cresson, Jr." The holotype is deposited with the Academy of Natural Sciences of Philadelphia, type number 6544. The following paratypes were also designated by Cresson: 2♀, Leelanau County, Michigan, 21 June 1937; 1♀, Beaver Dam, Wisconsin, 2 July 1915; 1♀, Moore's Lake, Anoka County, Minnesota, 19 June 1925; 1♀, Lake Calhoun, Hennepin County, Minnesota, 12 June 1921, 1♂ and 1♀, Orillia, Ontario, Canada, 17 July 1923, 1♀, Uhthoff Ontario, Canada, 14 July 1923.

DIAGNOSIS.—Specimens of *N. pallidipalpis* may be distinguished from those of all other species of the subgenus *Dichaeta* by the following combination of characters: Antennal segments entirely black; maxillary palpus pale, yellowish orange; mesonotum and mesopleuron immaculate; all tarsi pale, although front tarsomeres often slightly darker; setal fascicle of hind basitarsus pale; fascia of abdominal terga blackish brown with well-defined posterior margins. Characters of the terminalia of *N. pallidipalpis* males bear closest resemblance to those of *N. sicca* and *N. deserta*. The aedeagal apodemes of *N. deserta* and *N. pallidipalpis* males are especially similar and the hypandrial processes of both also closely resemble each other. However, differences are shown in Figures 171–172.

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.25 to 4.45 mm; with brownish gray to olive gray coloration and dark blackish brown markings.

Head: Head ratio 1:0.75; postfrons ratio 1:0.55; frons with median triangular area and lateral margins generally concolorous, however, the lateral



FIGURES 171–172.—*N. pallidipalpis:* 171, internal male genitalia, lateral aspect; 172, surstylus, lateral aspect.

margins are often lighter; remainder of frons darker brown with some blackish tinges, pollinose. Paravertical bristle larger than postocellar setae, subequal to genal bristle; 2 pair of proclinate, frontoorbital setae. Antenna entirely black; arista with 8–12 dorsal branches. Face pale, grayish yellow; prefrons ratio 1:0.62; facial setae hairlike. Eye ratio 1:0.72; eye-to-cheek ratio 1:0.185; gena concolorous with face anteriorly, becoming gray posteriorly; genal bristle as above. Maxillary palpus pale, mostly orange.

Thorax: Dorsum slightly darker than pleural areas, grayish brown to gray; mesonotum and mesopleuron immaculate. Femora and tibiae black with some gray dusted areas; front tarsomeres usually yellow but often with some darker areas; middle and hind tarsi yellow; setal fascicle of hind basitarsus pale. Wing ratio 1:0.41; costal vein ratio 1:0.53; M_{1+2} vein ratio 1:1.

Abdomen: Abdomen ratio of males 1:0.78; length of fourth tergum to fifth tergum ratio of males 1:1.12; fifth tergum ratio of males 1:0.67. Fascia dark brown with posterior edge distinct; fifth tergum mostly dark brown. Male terminalia as in diagnosis and Figures 171–172.

SPECIMENS EXAMINED (149).—CANADA: MANITOBA: Teulon (CNC); Wabowden (CNC). NEW BRUNSWICK: Cahmcook, Glebe Road (CNC). NOVA SCOTIA: Lockeport (CNC). ONTARIO: Britannia (CNC); Mer Bleue (ANSP, CNC); Norway Point, Lake of Bays (CNC); Orillia (ANSP); Uhthoff (ANSP). QUEBEC: Hull (CNC); Knowlton (CNC); Wakefield (CNC). SASKATCHEWAN: Waskesiu Lake (CNC); Waskesiu River (USNM); White Fox (CNC). UNITED STATES: IDAHO: Kootenai Co., 0.8 km E Harrison (WNM). IOWA: Hamilton Co., Goose Lake (USNM); Story Co., Ames (CNC); Wright Co., Little Wall Lake (USNM). MICHIGAN: Cheboygan Co. (KU, MSU, USNM), Mackinac City (ANSP); Crawford Co. (USNM); Iosco Co. (MSU); Iron Co., (USNM); Keweenaw Co., (USNM), Copper Harbor (ANSP); Leelanau Co. (USNM); Muskegon Co.

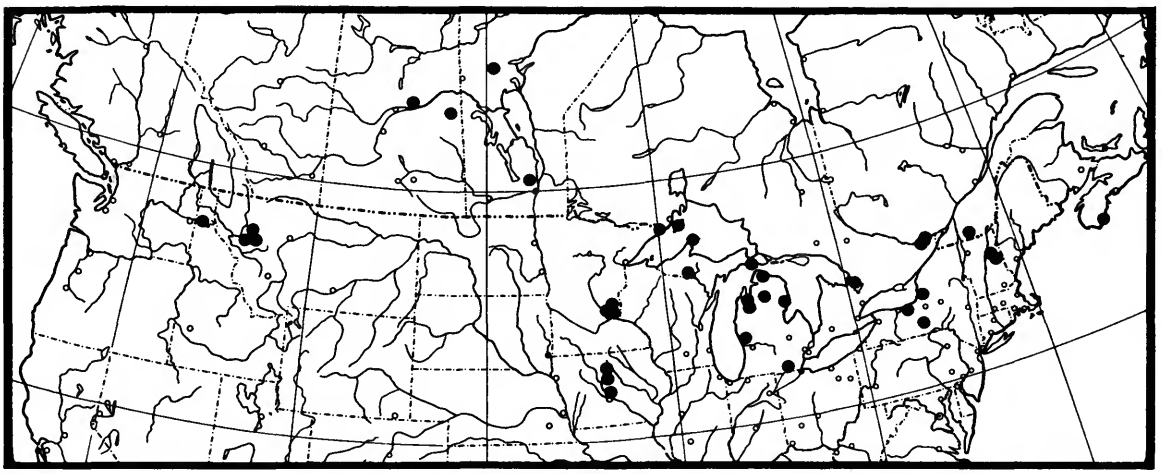


FIGURE 173.—*N. pallidipalpis:* distribution map.

(USNM); Grand Traverse Co. (USNM); Wexford Co. (USNM). MINNESOTA: Anoka Co., Moore's Lake (ANSP); Cook Co., Grand Marais (ANSP); Hennepin Co., Lake Calhoun (ANSP); Lake Co., Basswood Lake (UMN); Ramsey Co., Saint Anthony Park (UMN). MONTANA: Lake Co., 3.2 km W Bigfork (KSU), 3.7 km E Bigfork (WNM), 1.6 km S Swan Lake (WNM), 4 km S Swan Lake (WNM), 32.2 km S Swan Lake (KSU). NEW HAMPSHIRE: Lost River (ANSP); Crawford Notch (USNM); Lakes of the Clouds (CNC); Franconia Notch (ANSP, USNM); Grafton Co., Stinson Lake, White Mts. (MCZ, USNM). NEW YORK: Oswego Co., Saint Marys Pond (CU); Tompkins Co., Dryden Lake Outlet (CU); Wayne Co., Sodus Pt. (ANSP).

GEOGRAPHIC DISTRIBUTION (Figure 173).—The occurrence of *N. pallidipalpis* is apparently restricted to northern United States and southern Canada. Collection dates are from 3 June to 7 October.

REMARKS.—*Notiphila pallidipalpis* is a distinctive species of the subgenus *Dichaeta* with pale maxillary palpi and well defined abdominal fascia. It has been collected from both lotic and lentic water systems in sedge-meadow and reed-marsh habitats.

43. *Notiphila (Dichaeta) paludia,* new species

FIGURES 174–176

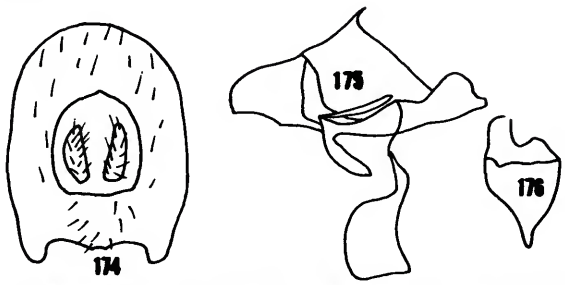
DIAGNOSIS.—Externally, specimens of *N. paludia* are very similar to many members of the *scalaris* group; I cannot distinguish this species without recourse to characters of the male genitalia. The most diagnostic character I have found is the shape of the hypandrial process. See Figures 174–176.

DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.4 to 4.2 mm; with light brown coloration and darker brown markings on the abdomen.

Head: Head ratio 1:0.75; postfrons ratio 1:0.60; frons mostly tan, median triangular area and lateral margins lighter in color, grayed, remainder of frons with charcoal tinges. Paravertical bristle not much larger than postocellar setae; 2 pair of proclinate, fronto-orbital setae. Antennal segments entirely dark, black; arista with 10–11 dorsal branches. Face light yellow, slightly dusted, prefrons ratio 1:0.68. Eye ratio 1:0.70; eye-to-cheek ratio 1:0.18. Gena narrow, concolorous with face anteriorly becoming grayer posteriorly, genal bristle approximately subequal to paravertical bristle. Maxillary palpus black.

Thorax: Mesonotum slightly darker than pleural areas, light brown, grayed anteriorly, immaculate. Mesopleuron immaculate. Femora and tibiae dark, mostly black but with some gray dusted areas, pale apically; tarsi usually pale, front tarsomeres often slightly darker. Setal fascicle of hind basitarsus pale. Wing ratio 1:0.44; costal vein ratio 1:0.46; M_{1+2} vein ratio 1:0.91.

Abdomen: Abdomen ratio of males 1:0.73; length of fourth tergum to fifth tergum of males 1:0.63; fifth tergum ratio of males 1:0.46. Fascia of abdominal terga 3 and 4 distinct, generally sharply contrasting with grayer posterior margin; fifth ter-



FIGURES 174–176.—*N. paludia:* 174, epandrium, cerci, and epandrial process, posterior aspect; 175, internal male genitalia, lateral aspect; 176, surstylus, lateral aspect.

gum mostly dark brown. Male genitalia as in Figures 174–176.

TYPE-MATERIAL.—Holotype male: "Nebraska Champion 12 July 1960, W. F. Rapp/HOLOTYPE Notiphila paludia Mathis (red)." Allotype female and 12 paratypes (4♂, 8♀): with same label data as the holotype. Other paratypes as follows: 1♂, 1♀, Nebraska, Wellfleet, 12 July 1960, W. F. Rapp (UN). The holotype will be deposited with the National Museum of Natural History, Smithsonian Institution, Washington, D.C., type number 73546.

ETYMOLOGY.—The epithet *paludia,* derived from the Latin noun *palus* ("marsh," "fen," or "bog"), refers to the typical habitat of this species.

GEOGRAPHIC DISTRIBUTION.—This species is known only from the fens of Nebraska.

REMARKS.—The structures of the male genitalia of this species are the only diagnostic characters that I was able to find. Because it occurs sympatrically with *N. olivacea* and is consistently difent with respect to the genitalic characters mentioned in the diagnosis, I feel justified in describing this taxon as a new species.

44. *Notiphila (Dichaeta) quadrisetosa* Thomson

FIGURES 177–185

Notiphila quadrisetosa Thomson, 1869:594.
Notiphila (Agrolimna) occidentalis Cresson, 1917:51. [New synonym.]
Notiphila (Agrolimna) quadrisetosa.—Wirth, 1965:747.

TYPE-MATERIAL.—Lectotype female (here designated): "California; Kinb./Typus: 292, 73 (pink)/ Riksmusuem, Stockholm (green)/LECTOTYPE Notiphila quadrisetosa Thomson by W. N. Mathis (red)." Six paralectotypes (1♂, 5♀): with the same label data as the lectotype except for the "typus" label and the accession numbers are from 293 to 298. The lectotype and paralectotype series are in the Naturhistoriska Riksmuseet, Stockholm, type number 292. The label data for the junior synonym are as follows: "Alameda, V, 5, 08, Cal., Salt Marsh/♂/HoloTYPE 6112/Holo-TYPE Notiphila occidentalis, E. T. Cresson Jr." The holotype of *N. occidentalis* is deposited in the Academy of Natural Sciences of Philadelphia, type number 6112; the terminalia have been removed and dissected, the parts are in an attached microvial.

DIAGNOSIS.—Externally, members of *N. quadrisetosa* are very similar to those of *N. atripes* and the melanic form of *N. uliginosa.* All of the above species are characterized by their overall dark appearance. However, specimens of *N. quadrisetosa* may be distinguished from those of similar congeners by the following characters: Specimens usually larger than those of *N. atripes;* with a median, bifurcating stripe on mesonotum, this generally absent or weakly developed in *N. atripes.* The differences between specimens of *N. quadrisetosa* and *N. uliginosa* are slight and difficult to ascertain except for the diagnostic characters of the male genitalia. The shape of the surstyli and hypandrial process are particularly characteristic (Figures 178–181).

DESCRIPTION.—Moderately small to moderately large shore flies, length 2.86 to 4.36 mm; with grayish brown to brown coloration and dark brown to black markings.

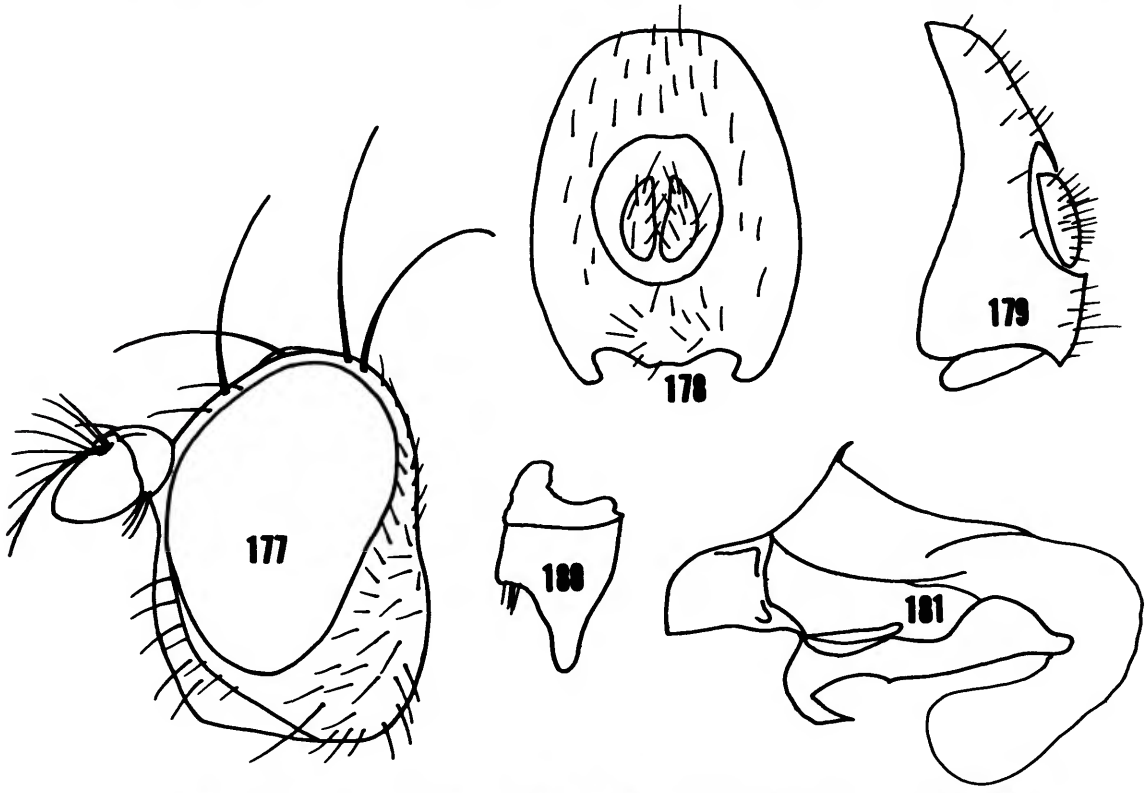
Head (Figure 177): Head ratio 1:0.79; postfrons ratio 1:0.75; frons pollinose, median triangular area and lateral margins concolorous, lighter in color, gray, remainder of frons charcoal tinged. Paravertical bristle large, approximately equal to genal bristle; 2 pair of proclinate, fronto-orbital setae. Antenna entirely black; arista with approximately 10 dorsal branches. Face entirely gray to lacteous, varying considerably; facial setae weakly developed, numbering 6–7; prefrons ratio 1:0.72. Eye ratio 1:0.75; eye-to-cheek ratio 1:0.19. Gena relatively narrow, usually grayer than face in color; genal bristle equal to paravertical bristle. Maxillary palpus black.

Thorax: Mesonotum brown, anteriorly somewhat grayed with some green tinges, usually with distinct median, bifurcating stripe. Pleural areas generally lighter in color than mesonotum, becoming grayer ventrally; mesopleuron with some darkened macu-

lation area but without distinct spot. Femora and tibiae concolorous, dark, gray dusted over large areas; front and middle tarsi also dark but with some pale areas, usually apically and on ventral surfaces; hind tarsomeres with considerable pallor, especially on venter. Setal fascicle of hind basitarsus pale. Wing ratio 1:0.44; costal vein ratio 1:0.54; M_{1+2} vein ratio 1:1.1.

Abdomen: Abdomen ratio of males 1:0.70; length of fourth tergum to fifth tergum ratio of males 1:0.72; fifth tergum ratio of males 1:0.59. Fascia of abdominal terga not contrasting distinctly with lighter, gray anterior margins; third and fourth terga often mostly dark brown to black, fifth tergum almost entirely dark. Male terminalia as in diagnosis and in Figures 178–181.

SPECIMENS EXAMINED (1132).—CANADA: BRITISH COLUMBIA: Hatzic Lake (CNC); Jaskatla-Queen Charlotte Islands (CNC); McClinton Bay-Queen Charlotte Islands (CNC); Mill Bay (CNC); Milner (CNC); Mission City (CNC); Okanogan Falls (CNC); Oliver (CNC); Salmon Arm (CNC); Vernon (CNC). UNITED STATES: ARIZONA: Cochise Co., 8.1 km W Portal-Southwest Research Station (CAS). CALIFORNIA: Alameda Co., Alameda (ANSP, CAS, USNM), Alvarado (CAS), Arroyo Mocho, 32.2 km S Livermore (UCB), Berkeley (ANSP, CAS), Emeryville (UCB); Del Norte Co., Smith River (USNM); Fresno Co., Centerville (UCR); Humboldt Co., Eureka (KU), Mad River Beach (UCB), Orick (ANSP); Inyo Co., Antelope Springs (UCB); Lake Co., Clear Lake (USNM); Lassen Co., NE Eagle Lake (WNM), Hallelujah Junction (UCB, UCD, UCR, USNM), 66 km NW Susanville (WNM); Los Angeles Co., Sangus (ANSP), Whittier (USNM); Mariposa Co., Yosemite National Park (KU); Modoc Co., 6.4 km W Alturas (WNM), Lookout (WNM); Mono Co., 30.6 km NW Benton (WNM), 11.3 km E Bodie (UCB), Coleville (CAS), Fales Hot Springs (UCB), Mono Lake (ANSP, CAS, KU, UCB, USNM, WNM), 3.2 km N Mono Lake (WNM); Monterey Co. (FSCA), Cala (AMNH), Moss Landing (CAS), Pacific Grove (ANSP, USNM); Nevada Co., Indian Spring Rd and Hwy 20 (UCR), Glenbrook (USNM), Floriston-E Truckee (ANSP, CSU); Orange Co., Laguna Beach (USNM), Sunset Beach (KU); Placer Co., Lake Tahoe (USNM); Plumas Co., Clio



FIGURES 177–181.—*N. quadrisetosa:* 177, head, lateral aspect; 178, epandrium, cerci, epandrial process, posterior aspect; 179, same, lateral aspect; 180, surstylus, lateral aspect; 181, internal male genitalia, lateral aspect.

(USNM); Riverside Co., Herkey Creek-San Jacinto Mountains (UCB), Keen Camp (USNM), Lake Hemet (CAS, UCR, USNM), Saboba Springs (CAS, USNM), Santa Ana River (USNM), Temecula (USNM); San Benito Co., New Idria (UCB); San Bernardino Co., Barton Flat (USNM), Barton Store (USNM); Sugarload-Barton Flat (USNM), Helendale (CNC), Little Cienega (UCR); San Diego Co., Descanso (ANSP), Lake Henshaw (USNM), Oak Grove (USNM); San Luis Obispo Co., Alamo Creek (USNM), Cambria (AMNH, USNM), Harmony (AMNH, USNM), Morro Bay (USNM), Oso Flaco Lake (UCB, UCR), San Simeon (ANSP, USNM); San Mateo Co., Redwood City (USNM); Santa Barbara Co., Lompoc (CU); Santa Clara Co., Palo Alto (ANSP, USNM), Stanford (USNM), San Antonio Ranger Station (UCB, USNM); Santa Cruz Co., Santa Cruz (CAS), Capitola (ANSP, WSU); Shasta Co., Big Spring (UCB), 6.4 km W Viola (UCB); Sierra Co., Goodyear Bar (CAS), Sierraville (UCB); Sonoma Co., Graton, 4.8 km NW (UCB); Stanislaus Co., Del Puerto Canyon (UCB); Trinity Co., Burnt Ranch (UCB); Tulare Co., 24.2 km NE California Hot Springs (WNM), 35.4 km NE California Hot Springs (WNM), E Success Reservoir (UCR), Three Rivers (USNM); Tuolumne Co., Pinecrest (CAS), Strawberry (UCD, USNM). IDAHO: Big Lost River-Salmon River Rd Pass (ANSP); 17.7 km N West Springs (MSU); Canyon Co., Notus (ANSP); Caribou Co., 1.6 km N Soda Springs (WNM); Custer Co., Challis (UCD); Gooding Co., Bliss (KU, USNM); Idaho Co., Grangeville (ANSP, USNM), Pollock (USNM), Whitebird (USNM); Kootenai Co., Coeur d'Alene-Echo Bay (USNM); Latah Co., Boville (WSU), Juliaetta (ANSP, USNM), Moscow (ANSP, USNM), Moscow Mountain (USNM), Potlatch (ANSP, USNM); Oneida Co., Rock Creek (USU); Valley Co., 38.6 km N Crouch (WNM), Smiths Ferry 8.1 km S (WNM). MONTANA: Flathead Co., 1.6 km W Bigfork (KSU), 16.1 km NE Bigfork (USNM); Lake Co., Black Lake, 3.2 km W Dayton (KSU, USNM), 4.8 km E Polson (KSU), 6.4 km E Polson (KSU, USNM), 12.9 km NE Polson (KSU, USNM), 1.6 km S Swan Lake (WNM); Missoula Co., Lolo Hot Springs-Lolo Creek (CU). NEW MEXICO: San Miguel Co., 0.8 km NE Montezuma (WNM); Valencia Co., Belen (USNM). NEVADA: Double Spring (ANSP, USNM); Douglas Co., 1.6 km S Genoa (WNM); Storey Co., Wadsworth (CAS); Washoe Co., Steamboat (USNM); White Pine Co., Charcoal Ovens State Park (UCD). OREGON: Sheep Creek (WSU); Benton Co., Corvallis (ANSP, MSU, USNM, WNM), Finley Wildlife Refuge (WNM); Coos Co., Marshfield (ANSP, USNM), North Bend (WSU); Harney Co., 25.8 km N Burns (WNM); Hood River Co., Hood River (USNM); Klamath Co., Deming Creek Reservoir (WSU), 35.4 km NE Klamath Falls (WNM); Jackson Co., Little Squaw Lake (WNM); Jefferson Co., Culver City (KU); Josephine Co., Kerby (ANSP, USNM); Lake Co., Goose Lake State Park (CU), Hart Mountain Refuge, Hot Spring (WNM), Hunter Hot Spring (WNM); Lane Co., 1.6 km E Cheshire (WNM), Eugene (WNM), 2.4 km E Florence (WNM), 12.9 km S Florence (WNM); Lincoln Co., Beaver Creek-Newport (USNM), Newport (ANSP, USNM); Linn Co., 1.6 km NE Crawfordsville (WNM); Tillamook Co., 3.2 km S Sand Lake (WNM), 4 km W Sand Lake (WNM); Umatilla Co., Hermiston (USNM), Ukiah (WSU); Wasco Co., 17.7 km N Warm Springs (WNM); Wheller Co., 29.8 km E Mitchell (WNM), Mountain Creek (USNM). UTAH: Trout Creek (ANSP), Box Elder Co., Brigham (UNM), Honeyville (UMN), Pleasant View (ANSP); Cache Co., Amalga (USU), Avon (USU), Blacksmith Fork Canyon (USU), Hyde Park (ISU, USU), Logan Canyon (CNC, USU), Smithfield (USU); Carbon Co., Clear Creek Canyon (ISU); Davis Co., Farmington (USNM); Emery Co., 0.8 km N Castle Dale (WNM); Juab Co., Goshiute Indian Reservation (USNM), Mount Nebo (UMN); Kane Co., Kanab (USNM); Morgan Co., Emigrant Canyon (USNM); Sevier Co., Sevier (USNM); Summit Co., Henfer (USU); Tooele Co., Vernon Creek (UMN); Utah Co., Goshen Pond (WNM), Lakeshore (ISU), Payson (UMN), Provo (UMN), Spanish Fork (KU); Wasatch Co., Heber (MSU, USNM), Strawberry Reservoir (USNM); Washington Co., 1.6 km W Saint George (WNM); Weber Co., Hooper (ANSP, USU), Ogden (ANSP, UMN). WASHINGTON: Blue Mountains (USNM); Holland (ANSP, USNM); Asotin Co., Asotin (USNM), Clarkston (ANSP, USNM); Columbia Co., Tucanon Ranger Station-Blue Mountains (USNM); Douglas Co., Waterville (UN, USNM); Grant Co., Coulee City (USNM), O'Sullivan Dam (USNM, WSU); Franklin Co., 11.3

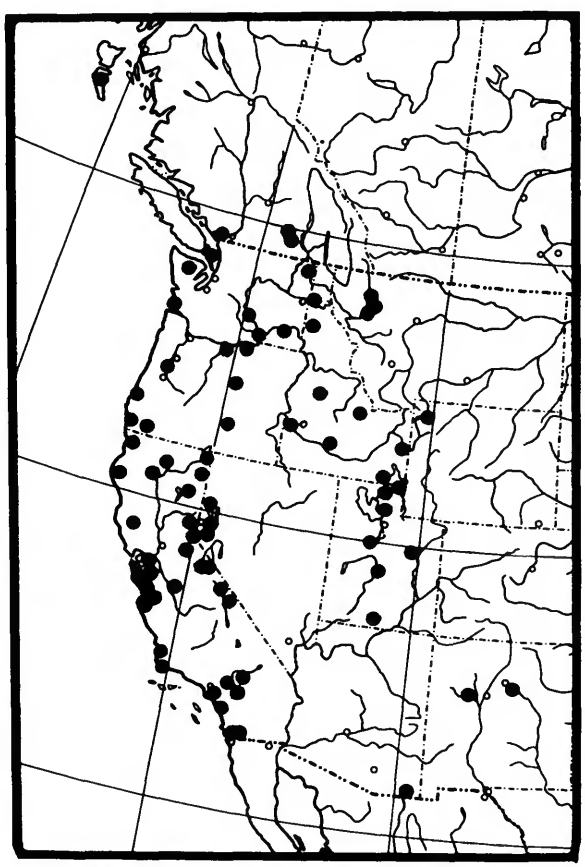


FIGURE 182.—*N. quadrisetosa:* distribution map.

FIGURE 183.—*N. quadrisetosa:* cluster of eggs, lateral aspect.

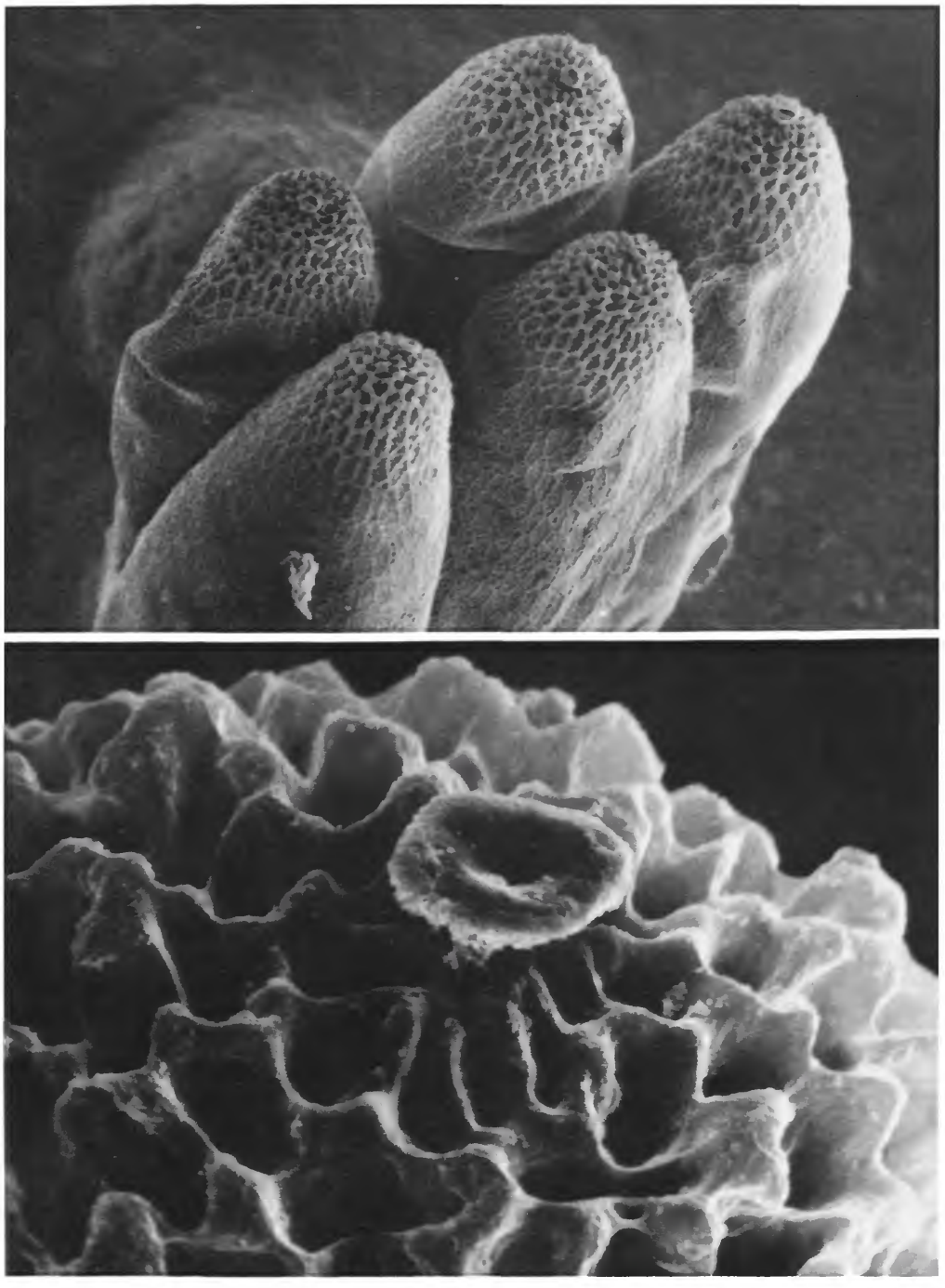
km WSW Eltopia (WNM); Jefferson Co., Brinnon (ANSP); Pacific Co., Naselle River (ANSP, USNM), Ilwaco (ANSP, USNM); Pend Oreille Co., Cusick (UN); Pierce Co., Longmire-Mount Rainier (ASNP, USNM); San Juan Co., Friday Harbor (USNM); Snohomish Co., Stanwood (USNM); Spokane Co., Valley Ford (USNM), Mica (USNM); Walla Walla Co., Mill Creek-Walla Walla (ANSP, USNM); Whatcom Co., Birch Bay (WSU); Whitman Co., Colfax (USNM), Pullman (ANSP, USNM, WSU); Yakima Co., Donald (CAS), Moxee (CAS), Naches (CAS), Yakima (USNM). WYOMING: Yellowstone National Park: Beach Springs (AMNH, ANSP, USNM), U. Geyser Basin (ANSP, USNM).

GEOGRAPHIC DISTRIBUTION (Figure 182).—*Notiphila quadrisetosa* is restricted to the mountainous states or provinces of western North America. Collection dates are from 5 April to 4 October.

REMARKS.—*Notiphila quadrisetosa* is widespread and variable, and reference to characters of the male genitalia is often necessary to distinguish it from related congeners. The medial, mesonotal stripe is usually constant but also varies as to the degree of darkness expressed. The hind tarsomeres are usually paler than those of *N. atripes,* but in some specimens the tarsi are as dark.

I have conducted natural history studies on *N. quadrisetosa* in both the field and laboratory. The field site was Dixon Creek, within the city limits of Corvallis, Benton County, Oregon. The bottom of the creek becomes overgrown with vegetation during the summer and provides a suitable habitat for this species.

Adult females oviposit in concealed sites. Eggs (Figures 183–185) are most commonly laid in clusters of three to ten, but I have found small, broken, straw stems with single eggs and on one occasion a dried, curled leaf with 15 to 20 eggs. Maturation of eggs in the laboratory required two to four days at room temperature (approximately 21° C). Immediately after hatching, the first-instar larva crawled down into the submerged substrate and attached to a rootlet. In the laboratory, the first-instar larva penetrated a fairly dense substrate of cotton, seeking the roots of various species of grasses that were



FIGURES 184–185.—*N. quadrisetosa:* 184, deeply ruguose sculpturing on eggs at microplyer end; 185, enlargement of micropyle.

allowed to germinate on the cotton. I was not successful in rearing the larvae past the second-instar, which died, I suspect from lack of proper nutrient. Crushed lettuce was tried as food but soon became fetid, stunting the growth of the grass roots. Field collected third-instar larvae and puparia were successfully reared. The third-instar larva developed noticeably yellow fat bodies along the sides of the alimentary canal just prior to puparium formation. Pupal development required seven to fourteen days at 21° C. A few days prior to eclosion of the pharate adult, a bright red eye spot becomes visible.

Notiphila quadrisetosa is probably multivoltine in Oregon and over-winters as a larva. I was not successful, however, in collecting any stage during the winter. Puparia were collected as early as the last week of April but were more common in May. Larvae and puparia were collected throughout the summer. I suspect that the length of the life cycle of *N. quadrisetosa* is similar to that of *N. caudata*, which lasts 19 to 44 days in northern Ohio (Eastin and Foote, 1971).

In the field, larvae and puparia of *N. quadrisetosa* were found attached to the roots of an *Agrostis* species, feral lawn grass, and occasionally to the roots of *Typha latifolia*. Neither the larvae nor the puparia were found on the roots of a sedge, which was abundant in this habitat. Usually the immature stages were found within the first one to two inches of substrate and often were found in loose clusters of several larvae or puparia, all attached to the same root system. Apparently there is either little active dispersal of the immature stages, or the immediate conditions surrounding a particular root system were preferable. The upper levels of substrate at this site are very sandy and overlay the more organic mud below. Larvae and puparia were more common in the sandy layers.

I have collected adults of *N. quadrisetosa* from a wide variety of habitats, from brackish-water sedge meadows to sulfurous hot springs.

45. *Notiphila (Dichaeta) scalaris* Loew

FIGURES 186–189

Notiphila scalaris Loew, 1862:134.
Notiphila (Agrolimna) scalaris Cresson, 1917:49.

TYPE-MATERIAL.—Lectotype male (here designated): "Mittel St. (green)/Loew Coll./scalar. ♂/Type 11129 (red)/*Notiphila scalaris* Lw. det. W. Wirth '61." The lectotype is in the Museum of Comparative Zoology, Harvard University, type number 11129. I have not seen the female type Loew listed in the original description but I have examined a second male specimen with label data similar to the lectotype except that its type label has the number 2 in addition to the type number. This second male specimen may be the "female" of Loew.

DIAGNOSIS.—Externally, specimens of *N. scalaris* are very similar to those of *N. sicca* and *N. atripes;* the close relationship with *N. atripes* is further evidenced by the resemblances of the male genitalia. Specimens of *N. scalaris* may be distinguished from those of similar congeners by the following combination of characters: Antenna entirely black, without any pale coloration at base of third segment; mesonotum generally immaculate or with a median stripe only faintly indicated; mesopleuron with a darkened area on dorsal half; middle and hind tarsi pale, yellowish; setal fascicle of hind basitarsus pale; abdominal fascia dark brown, contrasting sharply with posterior margins of each abdominal tergum; fascia continuing on ventral surfaces; male genitalia distinctive, especially the shape of the hypandrial process (Figures 186–188).

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.80–3.78 mm; with light brownish gray to gray background coloration and dark brown markings.

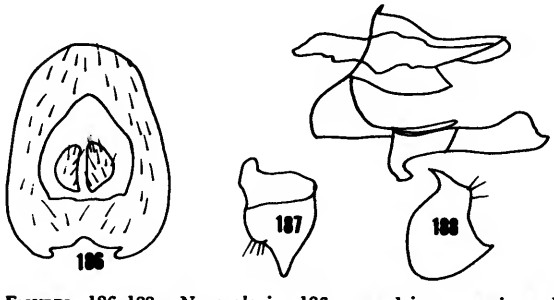
Head: Head ratio 1:0.75; postfrons ratio 1:0.62; frons with median triangular area and lateral margins concolorous, gray; remainder of frons darker, charcoal gray. Paravertical bristle larger than postocellar setae; 2 pair of proclinate, fronto-orbital setae. Antennal segments entirely black; arista with 9–11 dorsal branches. Face grayish yellow, prefrons ratio 1:0.61; facial setae small, hairlike, numbering 6–7. Eye ratio 1:0.81; eye-to-cheek ratio 1:0.15. Gena narrow, genal bristle subequal to paravertical bristle. Maxillary palpus black.

Thorax: Mesonotum slightly darker than pleural areas, more brown, usually without median stripe although some specimens have a faint indication of one. Mesopleuron with a darkened area on the dorsal half. Femora, tibiae, and front tarsomeres dark, generally black with some gray or pale areas; middle and hind tarsi pale, yellow. Setal fascicle of

hind basitarsus pale, yellow. Wing ratio 1:0.45; costal vein ratio 1:0.48; M_{1+2} vein ratio 1:0.98.

Abdomen: Abdomen ratio of males 1:0.80; length of fourth tergum to fifth tergum ratio of males 1:0.88; fifth tergum ratio of males 1:0.53. Fascia of abdominal terga very distinct, markedly contrasting with gray posterior marigns, continuing on ventral surfaces. Male terminalia as in Figures 186–188.

SPECIMENS EXAMINED (735).—CANADA: NOVA SCOTIA: Antigonish (CNC); Whycogomah-Cape Breton Island (MCZ). ONTARIO: Burks Falls (CNC); Emsdale (CAS); Frankford (CNC); Grand Bend (CNC); Kearney (CAS); Mer Bleue (CNC); Midland (CNC); Orillia (ANSP, CNC); Putnam (CNC); Sandford (CU); Severn (CNC); Simcoe (CNC); Toronto (CAS); Turkey Point (CNC). QUEBEC: Abbotsford (CNC); Covey Hill (CNC); Hull (ANSP, CNC); Kazabazua (CNC); La Trappe (CNC); St. Chrysostome (CNC); Wakefield (CNC). UNITED STATES: Washington, D.C. (CSU, MCZ), Rock Creek (USNM). CONNECTICUT: Hartford Co., Avon-Avon Old Farms (AMNH); Tolland Co., STORRS (ANSP). ILLINOIS: Du Page Co., Glen Ellyn (USNM); McHenry Co., Algonquin (INHS, USNM); Vermilion Co., Muncie (INHS). INDIANA: Knox Co., Vincennes (ANSP, USNM); Tippecanoe Co., La Fayette (ANSP, USNM). IOWA: Boone Co., Boone (ISU); Guthrie Co., Springbrook State Park (ISU); Howard Co., Lime Springs (ISU). KANSAS: Riley Co., Manhattan (KNSU); Stafford Co., Salt Marsh (KU). MAINE: Penobscot Co., Orono (CAS). MARYLAND: Charles Co., Popes Creek (MCZ); Baltimore Co., Lock Raven (ANSP), Womomonee (USNM); Calvert Co., Chesapeake Beach (USNM); Prince Georges Co., Branchville to Beltsville (USNM), College Park (USNM). MASSACHUSETTS: Ellis (MCZ); Barnstable Co., Pocasset (USNM), Woods Hole (USNM); Berkshire Co., North Adams (MCZ); Bristol Co., New Bedford (USNM); Middlesex Co., Concord (MCZ, USNM); Plymouth Co., Middleboro (USNM); Worcester Co., Athol (ANSP), Petersham (USNM). MICHIGAN: Benzie Co., (USNM); Berrien Co., Saint Joseph (MSU); Calhoun Co., Battle Creek (ANSP), Wise Lake (MSU); Cheboygan Co. (KU); Clare Co. (MSU, USNM); Clinton Co., Bath (MSU); Delta Co. (MSU); Gladwin Co. (USNM); Grand Traverse Co., Traverse City (ASNP); Huron Co. (USNM); Isabella Co. (MSU, USNM); Lapeer Co., Deerfield Twp. (UMI, USNM); Leelanau Co. (ANSP, USNM); Macomb Co., New Baltimore (USNM), Utica (ANSP, USNM); Manistee Co., Manistee (USNM); Mecosta Co. (MSU, USNM); Midland Co. (ANSP, MSU, USNM); Monroe Co., Monroe (USNM); Muskegon Co. (MSU, USNM), North Muskegon (CAS); Oceana Co., Hart (ANSP), Shelby (ANSP); Osceola Co. (MSU, USNM); Wayne Co. (MSU, UMI), Detroit (USNM). MINNESOTA: Anoka Co., Saint Paul Water Works (UMN); Clearwater Co., Itasca State Park (UMN); Hennepin Co., Lake Calhoun (ANSP, UMN); Houston Co. (UMN, USNM); Rock Co., Luverne (MSU); Wabasha Co., Wabasha (UMN); Winona Co., Winona (ANSP); Wright Co., Howard Lake (UMN). NEBRASKA: Blaine Co., Dunning (MSU); Butler Co., Bellwood (UN); Chase Co., Champion (UN); Cherry Co., Valentine (ISU). NEW HAMPSHIRE: Grafton Co., Benton (ANSP), Franconia (AMNH, USNM), North Haverhill (USNM). NEW JERSEY: Lake Branch (MCA); Shark River (MCZ); Camden Co., Berlin (CU), Clementon (MCZ); Cape May Co., Anglesea (MCZ), Wildwood (MCZ); Essex Co., Forest Hill (AMNH), West Orange (AMNH); Sussex Co., Branchville (AMNH). NEW YORK: Albany Co., Voorheesville (NYSM); Cattaraugus Co., Ashford (KU), Gowanda (CAS); Cortland Co., Harford (ANSP, CU), McLean Bog (CU, USNM); Delaware Co., Stamford (CU); Erie Co., Colden (CAS), Hamburg (CAS); Essex Co., Lake Tear (MCZ); Franklin Co., Saranac Inn (ANSP, NYSM); Fulton Co., Johnstown (ANSP, CU); Genessee Co., Bergen (KU); Hamilton Co., 11.3 km S Long Lake (ISU), Inlet (CU); Jefferson Co., Ellisburg (CU); Monroe Co., Rochester (CAS); New York Co., New York (AMNH, USNM); Niagara Co., Niagara (MCZ, USNM); Rockland Co., Bear Mountain (USNM); Suffolk Co., Babylon (CU), Cold Spring Harbor (USNM), East Hampton (USNM), Montauk (USNM), Orient (USNM); Sullivan Co., Bridgeville (CU); Tomkins Co., Dryden Lake (ANSP, CU), Ithaca (ANSP, CU, USNM), Mallory (CU), Mud Creek (ANSP, CU), Slaterville (ANSP, CU), Taughannock Falls (USNM), Woodwardia Bog (ANSP, CU); Westchester Co., Beaver Hill (ANSP), Peckskill (USNM). NORTH CAROLINA: Buncombe Co., Black Mountain (MCZ); Macon Co., Franklin (CNC), Highlands (ISU); Transylvania Co., Toxowany Falls (CNC). NORTH DAKOTA: Richland Co., 40.3 km N Wyndmere (UCB). OHIO: Carroll Co., Specht Marsh (KSU); Champaign Co. (USNM), Cedar Swamp (FSCA); Erie Co., Sandusky (ANSP, FSCA, OHSU); Franklin Co., Columbus (ANSP, OHSU); Medina Co., Hinkley (ANSP, OHSU), Wadsworth (KSU); Portage Co., 1.6 km E Kent (KSU), 7.2 km NW Kent (KSU, USNM); Summit Co., Akron (ANSP, OHSU), Hawkins (ANSP, OHSU). PENNSYLVANIA: Castle Rock (ANSP); Allegheny Co., Natrona (MCZ), Pittsburgh (USNM); Bucks Co., Point Pleasant (ANSP); Dauphin Co., Grantville (CNC); Fulton Co., McConnelsburg (ANSP); Monroe Co., Pocono Lake (ANSP); Montgomery Co., Edge Hill (MCZ); Philadelphia Co., Germantown (ANSP), Holmesburg (ANSP), Philadelphia (MCZ), Roxborough (ANSP). RHODE ISLAND: Washington Co., Charlestown (USNM). SOUTH DAKOTA: Bennett Co., Martin (ANSP); Yankton Co., Yankton (UN). TENNESSEE: Sullivan Co., Bristol (USNM). VIRGINIA: Four-mile Run (ANSP): Glencarlyn (ANSP, MCZ): Potomac



FIGURES 186–188.—*N. scalaris:* 186, epandrium, cerci, and epandrial process, posterior aspect; 187, surstylus, lateral aspect; 188, internal male genitalia, lateral aspect.

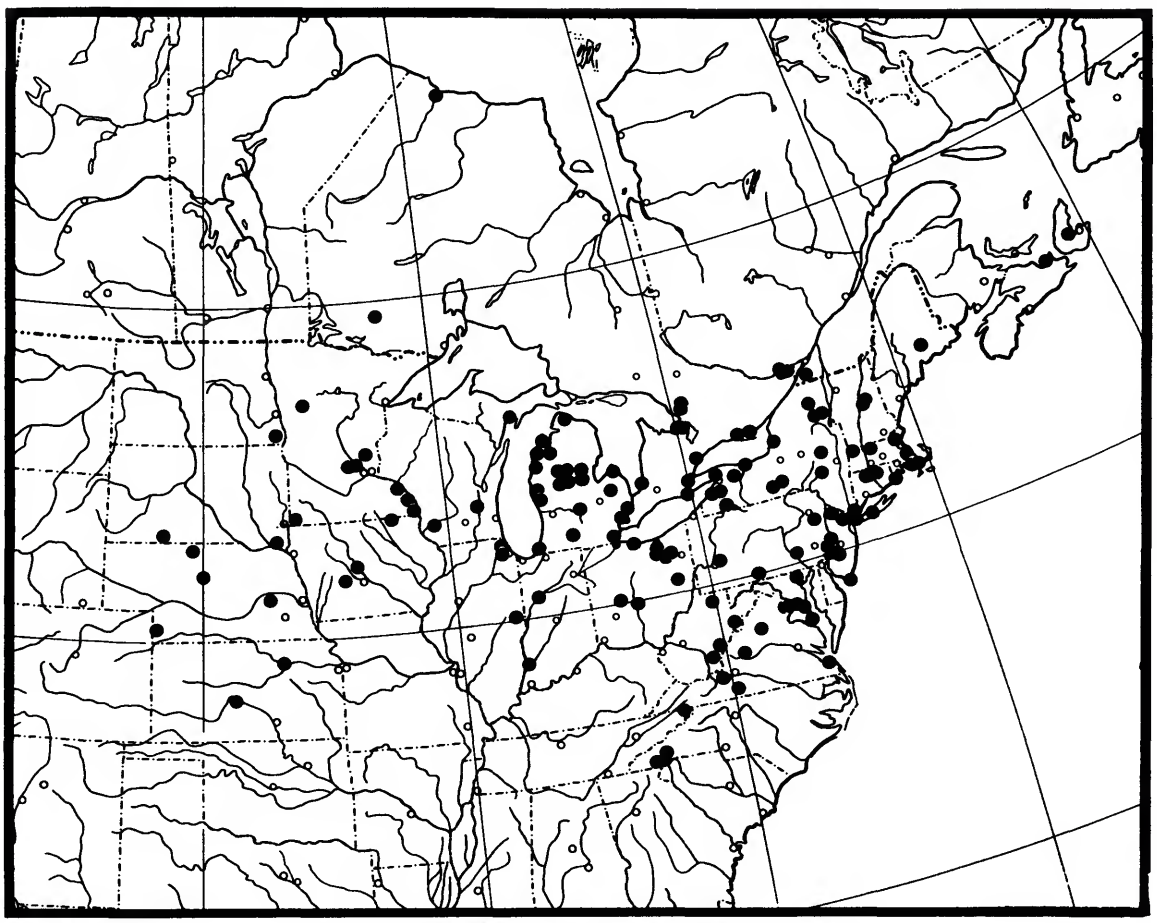


FIGURE 189.—*N. scalaris:* distribution map.

Creek (MCZ); Fairfax Co., Falls Church (ANSP, MCZ), Potomac River at Scott Run (USNM); Greene Co., Dyke (MCZ); Henry Co., Martinsville (CNC); Montgomery Co., Blacksburg (CNC); Norfolk Co., Norfolk (MCZ); Rockbridge Co., Natural Bridge (USNM). WEST VIRGINIA: Greenbrier Co., Lewisburg (USNM); Hardy Co., Baker (USNM); Marion Co., Fairmont (ANSP); Pocahontas Co., Cranberry Glades (USNM). WISCONSIN: Dodge Co., Beaver Dam (ANSP); Grant Co., Boscobel (MSU, UMI).

GEOGRAPHIC DISTRIBUTION (Figure 189).—*Notiphila scalaris* is one of the few species of the subgenus *Dichaeta* that is limited in distribution to eastern North America, although it has not been reported from the Gulf Coast states of southeastern United States. Collection dates are 19 April to 14 September.

46. *Notiphila (Dichaeta) sicca* Cresson

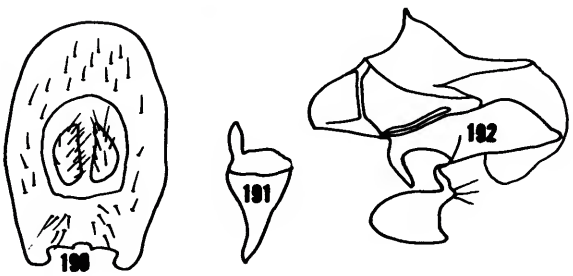
FIGURES 190–193

Notiphila sicca Cresson, 1940:8.
Notiphila (Agrolimna) sicca.—Cresson, 1946:233.

TYPE-MATERIAL.—Holotype female: "Owens, Nev(ada). Clark Co. 8–23 '(19)19, 3000 ft [910 m]/ ♀ /TYPE Notiphila sicca E. T. Cresson, Jr. 6597." The holotype is deposited in the Academy of Natural Sciences of Philadelphia, type number 6597. Cresson also listed a second female paratopotype. The type number was published as 6543 but the number on the type specimen is 6597.

DIAGNOSIS.—Evidently, *N. sicca* is closely related to *N. pallidipalpis,* to which it is very similar. How-

ever, specimens of *N. sicca* may be distinguished from those of *N. pallidipalpis* or any other species of the subgenus by the following combination of characters: Antenna entirely black except for base of third segment, which is pale orange; maxillary palpus black; both mesonotum and mesopleuron immaculate; setal fascicle of hind basitarsus pale; abdominal fascia, which are blackish brown to black, well defined with distinct posterior margin. Terminalia of *N. sicca* males also distinctive: Hypandrial process very similar to that of *N. deserta* males but surstyli differing considerably; surstyli also distinct from males of *N. sicca* and *N. pallidipalpis*.



FIGURES 190–192.—*N. sicca:* 190, epandrium, cerci, and epandrial process, posterior aspect; 191, surstylus, lateral aspect; 192, internal male genitalia, lateral aspect.

DESCRIPTION.—Moderately small to medium-sized shore flies, length 2.87 to 3.93 mm; with brownish gray to olive gray coloration and dark brown to black markings.

Head: Head ratio 1:0.71; postfrons ratio 1:0.49; frons more or less totally subdued, grayish, pollinose, but with outline indications of median triangular area and the lateral margins; median triangular area often lighter in color, grayer. Paravertical bristle larger than postocellar setae, subequal to genal bristle; 2 pair of proclinate, fronto-orbital bristles. Antenna entirely black except for base of third segment which is pale, orange; arista with usually 9–12 dorsal branches. Face yellow, subdued; facial setae hairlike; prefrons ratio 1:0.60. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.12. Gena narrow, gray except for anterior portion which is concolorous with face. Genal bristle as noted above. Maxillary palpus black.

Thorax: Light brownish gray to olive gray; mesonotum and mesopleuron immaculate. Femora and tibiae black with some gray dusted areas; tarsi pale, yellow; setal fascicle of hind basitarsus pale. Wing ratio 1:0.44; costal vein ratio 1:0.46; M_{1+2} vein ratio 1:1.

Abdomen: Abdomen ratio of males 1:0.82; length of fourth tergum to fifth tergum ratio of males 1:0.84; fifth tergum ratio of males 1:0.58. Fascia of third and fourth terga well defined, rectangular; fifth segment mostly concolorous with fascia, but with some gray areas toward venter on lateral margins. Male terminalia as in Figures 190–192.

SPECIMENS EXAMINED (654).—ARIZONA: Apache Co., (KU); Cochise Co., Chiricahua Mountains (KU); Coconino Co., (KU); Yavapai Co., Montezuma Wells National Monument (USNM, UA). CALIFORNIA: Inyo Co., Deep Springs (UCD, UCR, USNM), Little Lake (USNM), Lone Pine (UCB, CAS), Panamint Springs (CNC); Kern Co., South Inlet-Lake Isabella (UCR); Mono Co., Mammoth Lakes (KU); Riverside Co., Aguanga (USNM); San Bernardino Co., Baker (ANSP, USNM), Victorville (CU); San Diego Co., 3.2 km N Warner Springs (CUR). COLORADO: Fremont Co., (KNSU); Huerfano Co., Walserburg (CSU); Larimer Co., Fort Collins (ANSP, CSU, WSU); Montezuma Co., 12.9 km W Cortez (WNM); Otero Co., 8.1 km N Rocky Ford along Arkansas River (ISU); Pueblo Co., (USNM); Weld Co., Greeley (CSU). IDAHO: Gooding Co., Bliss (KU). IOWA: County number 3 (?)(USNM); Dickinson Co., fen SW Silver Lake (ISU), Excelsior Fen (ISU). KANSAS: Scott Co., (KU). MINNESOTA: Clearwater Co., (UMN); Cook Co., Grand Marais (UMN); Hennepin Co., (UMN); Ramsey Co., (UMN). MONTANA: Flathead Co., 12.9 km NW Bigfork (KSU). NEBRASKA: Chase Co., Champion (UN), 16.1 km SW Imperial (UN); Frontier Co., Curtis (UN). NEVADA: Nye Co., Ash Meadows (ANSP). NEW MEXICO: Catron Co., Apache Creek (WNM), Zumi Salt Lake 32.2 km W Quemado (USNM); Guadalupe Co., Santa Rosa (KU); Otero Co., Alamogordo (KU), 40.3 km W Tularosa (KU); Sandoval Co., Jemez Mountains (ANSP); San Juan Co., 1.6 km S Bloomfield (WNM); San Miguel Co., 0.8 km NE Montezuma (WNM); Socorro Co., Blue Springs (USNM); Valencia Co., Belen (KU). OHIO: Erie Co., Sandusky (ANSP). OREGON: Jefferson Co., Culver City (USNM); Harney Co., 14.5 km N Andrews-Alvord Hot Springs (WNM). SOUTH DAKOTA: Cascade Springs (ANSP). TEXAS: Galveston Co., Galveston (AMNH, FSCA). UTAH: Naples (ANSP); Beaver Co., Beaver (UMN), Beaver Canyon (UMN); Box Elder Co., Honeyville (UMN), Locomotive Springs (USU); Carbon Co., S. Price (WNM); Emery Co., 0.8 km N Castle Dale (WNM), Green River (UMN); Grand Co., Moab (ISU, USNM); Iron Co., Cedar City (KU, USNM); Kane Co., Kanab (ISU), Kanab Creek Canyon (ISU); San Juan Co., Indian Creek (USU), 10.5 km N LaSal Junction (WNM); Sanpete Co., Manti (ANSP); Sevier Co., 14.5 km E Cove Fort in Fish Lake National Forest (ISU), Fish Lake (KU); Utah Co., American Fork (USU), Goshen (USU), Goshen Ponds (WNM), Provo (UMN), Payson (UMN), Spanish Fork (ISU); Wayne Co., Capital Reef (USU); Weber Co., Hooper (USU). WYOMING: Yellowstone National Park, U. Geyser Basin (ANSP, USNM).

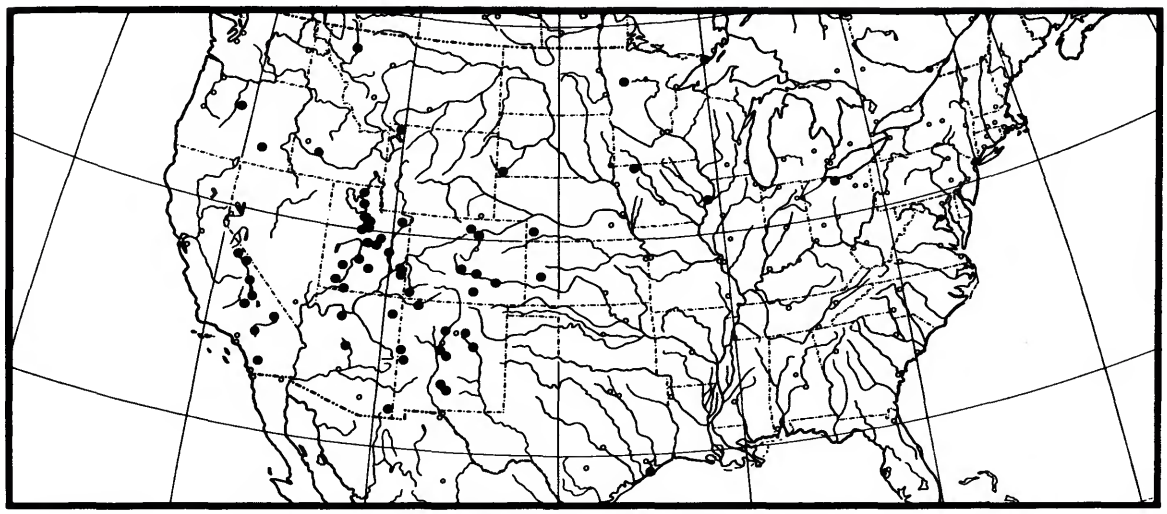


FIGURE 193.—*N. sicca:* distribution map.

GEOGRAPHIC DISTRIBUTION (Figure 193).—This species occurs in most of the United States west of the 100th parallel except for the extreme Northwest. I have also examined specimens from Minnesota and Ohio. Collection dates are from 10 March to 7 October.

REMARKS.—Although *N. sicca* is a common species in the West, it was not described until relatively recently (Cresson, 1940). It often occurs abundantly, especially in arid areas where some water is found.

47. *Notiphila (Dichaeta) uliginosa* Haliday

FIGURES 194–204

Notiphila uliginosa Haliday, 1839:222.
Notiphila (Agrolimna) olivacea Cresson [in part], 1917:52.

TYPE-MATERIAL.—I have not located Haliday's syntype series of this species, but Haliday's original description does list the following localities for the syntypes (all in Ireland or Northern Ireland): (1) marsh between Glengariff and Adrighoule (County Cork); (2) banks of the Shannon at Tarbert (County Kerry, Shannon River); (3) shores of Belfast Lough (Northern Ireland). All of the localities for the syntype series are brackish-water marshes along bays or rivers leading to the ocean. I have examined European specimens from Denmark and Sweden.

DIAGNOSIS.—*N. uliginosa* is a variable species, whose specimens closely resemble other members of the *scalaris* group, especially *N. quadrisetosa.* Specimens may be distinguished from all related species by characters of the male postabdomen, especially the shape of the hypandrial process (Figures 197–203). Externally, specimens of *N. uliginosa* differ from those of *N. olivacea* in the extent and degree of coloration contrast between the darkened abdominal fascia and the olivaceous to gray background color. Usually the color of the fascia of *N. uliginosa* members do not contrast distinctly but merge gradually together, and generally the fascia are also more extensive. The melanic form of *N. uliginosa* members may be differentiated from those of *N. quadrisetosa* by the absence of a median, bifurcating, mesonotal stripe. Often the facial color is grayer in the melanic form of *N. uliginosa,* but there is considerable overlap in this character with specimens of *N. quadrisetosa.*

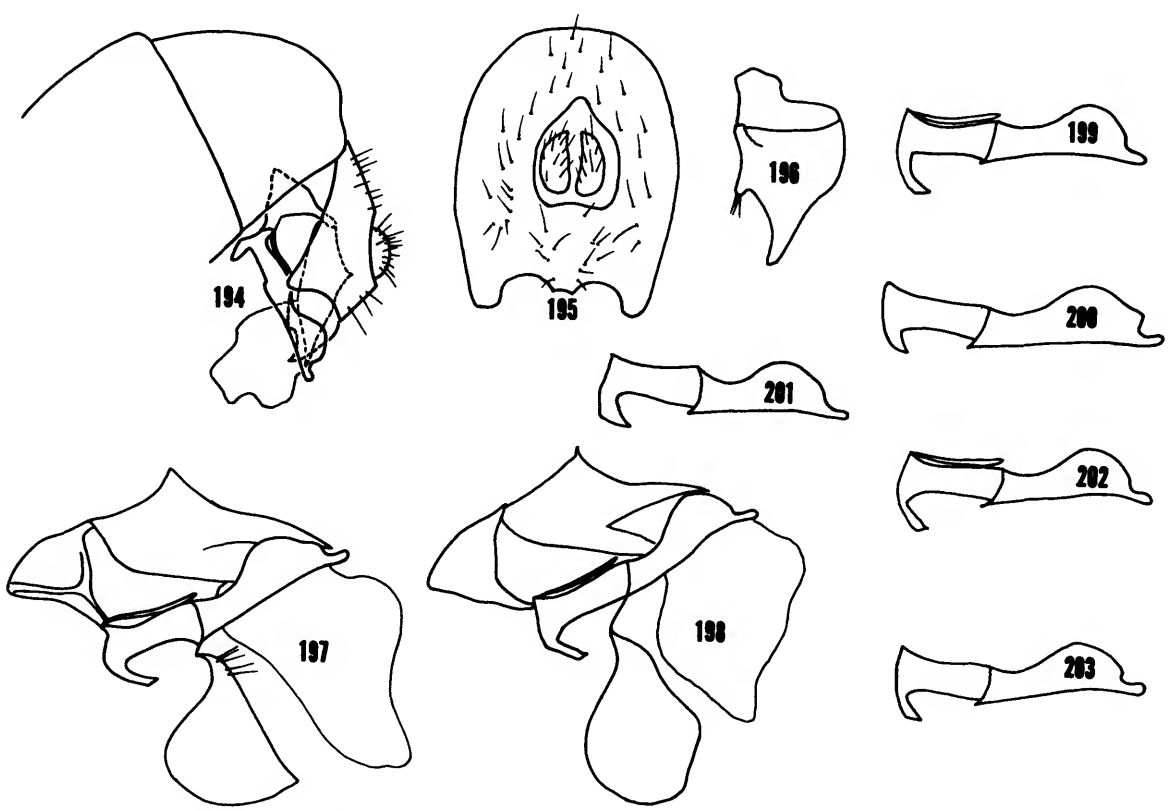
DESCRIPTION.—Medium-sized to moderately large shore flies, length 3.46 to 4.53 mm; with yellowish brown to olivaceous background coloration and some brown markings.

Head: Head ratio 1:0.73; postfrons ratio 1:0.61; frons mostly dark brown with some darker, charcoal coloration; median triangular area and lateral margins concolorous, lighter in color, tending to be more yellowish. Paravertical bristle large, approximately one-half to one-third longer than larg-

est postocellar setae; 2 pair of proclinate, frontoorbital setae. Antennal segments entirely dark, dark brown to black; arista with 7–9 dorsal branches. Face dusted yellow; prefrons ratio 1:0.74; facial setae hairlike, numbering 6–7 and usually extending dorsally past midheight of face. Eye ratio 1:0.78; eye-to-cheek ratio 1:0.21. Gena fairly narrow, concolorous with face anteriorly, becoming grayer posteriorly; genal bristle distinct, subequal to paravertical bristle. Maxillary palpus dark, brownish black.

Thorax: Mesonotum slightly darker in coloration than pleural areas but not distinctly contrasting, immaculate. Scutellum approximately concolorous with mesonotum. Mesopleuron generally immaculate; remaining pleural areas tending to become lighter ventrally but not distinctly grayed or contrasting with dorsal portions. Femora dark, dusted gray; tibiae black, also with some gray dusted areas; front tarsomeres mostly blackish but with extensive pale areas at apices and beneath, middle and hind tarsi pale. Setal fascicle of hind basitarsus pale, yellowish orange. Wing ratio 1:0.42; costal vein ratio 1:0.50; M_{1+2} vein ratio 1:1.1.

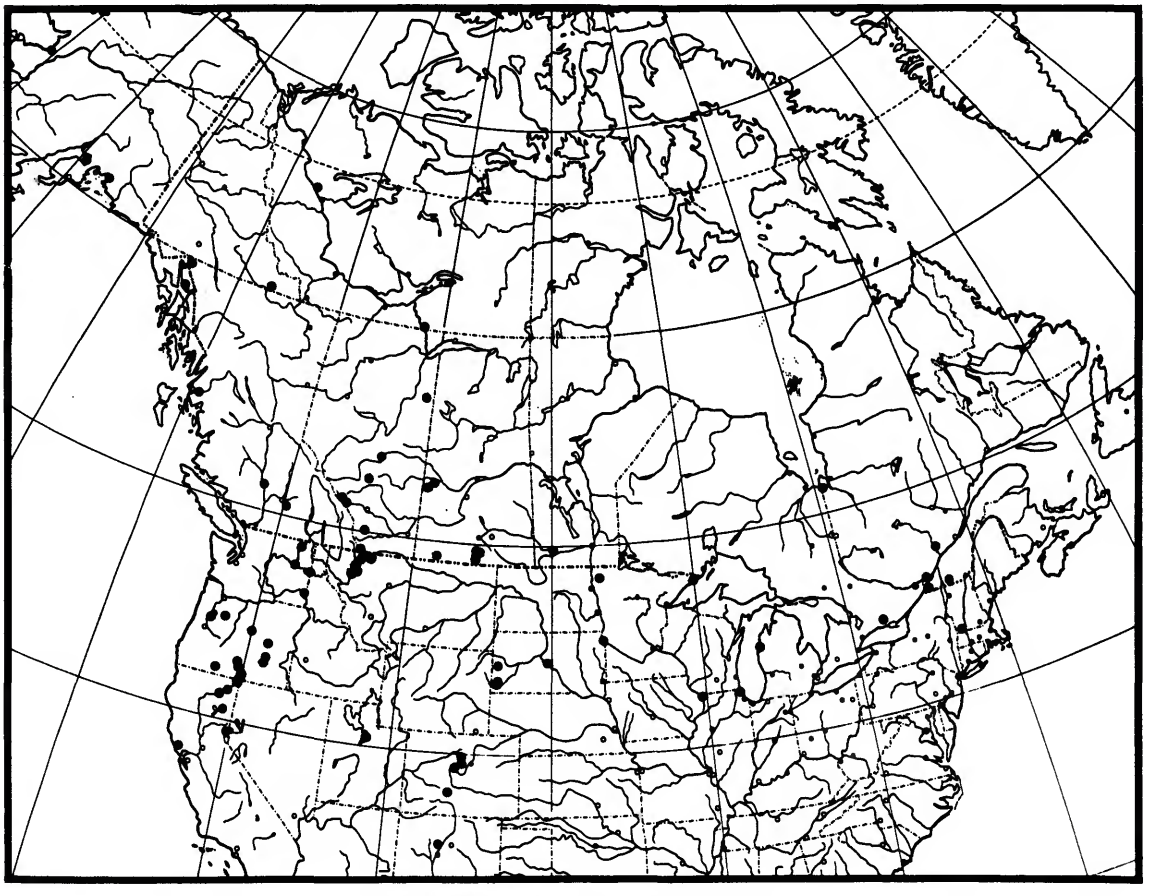
Abdomen: Abdomen ratio of males 1:0.64; length of fourth tergum to fifth tergum ratio of males 1:0.97; fifth tergum ratio of males 1:0.61. Coloration of terga mostly olivaceous, darker areas on third, fourth, and fifth terga rather diffuse, not distinctly contrasting with background color, gradually merging. Male terminalia as in Figures 194–203.



FIGURES 194–203.—*N. uliginosa:* 194, posterior end of abdomen and male genitalia, lateral aspect; 195, epandrium, cerci, and epandrial process, posterior aspect; 196, surstylus, lateral aspect; 197, internal male genitalia, lateral aspect (Great Lakes); 198, internal male genitalia, lateral aspect (Alaska); 199–203, hypandrial process, lateral aspect (199, Watson Lake, Yukon Territory; 200, Parry Island, Ontario; 201, Harney County, Oregon; 202, Babb, Montana; 203, Valdez, Alaska).

Melanic form. As above except as follows. Face often gray but usually dusted yellow. Legs entirely dark, usually black except for tarsal brushes and setal fascicle of hind basitarsus which are pale. Abdominal fascia brown, distinct on terga 3–5; fifth tergum almost entirely dark. The general coloration also tends to be more brown rather than olivaceous.

SPECIMENS EXAMINED (518).—CANADA: ALBERTA: Banff (CNC); 20.9 km N Banff-Jasper Highway (CNC); Cooking Lake (ANSP); Carmangay-Little Bow River (USNM); Edmonton (CAS); Full Lake (ANSP); Gull Lake (CNC); McMurray (CNC); Nordegg (ANSP, CNC); Waterton Lakes (CNC). BRITISH COLUMBIA: Atlin (CNC); Clinton (CNC); King Salmon Lake (CNC); Lakelse Hot Spring (CNC); Lakelse near Terrace (CNC); Vernon (CNC). MANITOBA: Brandon (CNC); 8.1 km SW Shilo (CNC); Wabawden (CNC). NORTHWEST TERRITORIES: Fort Smith (CNC); Norman Wells (CNC). ONTARIO: Marmora (CNC). QUEBEC: Brome Lake (CNC); Covey Hill (CNC); Lac Mondor-Ste. Flore (CNC); La Trappe (AMNH, FSCA, MSU); Missisquoi Bay (CNC); Rupert House (CNC); Saint Chrysostome (CNC); Saint Placide (AMNH). SASKACHEWAN: Assiniboia (CNC); Attons Lake-Cut Knife (CNC); Cut Knife (CNC); Lisieux (CNC); Rutland Station (CNC); Val Marie (CNC); Willows (CNC). YUKON TERRITORY: Watson Lake (CNC). UNITED STATES: ALASKA: Anchorage (ANSP); Auke Bay (WSU); Unalakleet (CNC); Valdez, tidal flats (USNM). CALIFORNIA: Lassen Co., 66 km NW Susanville (WNM); Marin Co., 24.2 km NW Olema (UCB); Modoc Co., 6.4 km W Alturas (WMN); Lookout (WMN), Surprise Valley-Fort Bidwell (UCB); Nevada Co., 1.6 km NW Hobart Mills (WNM), 4 km NE Hobart Mills (WNM). COLORADO: Boulder Co., Nederland (ANSP, CSU, KU, USNM, WSU); Clear Creek Co., Echo Lake-Mount Evans (CNC); Park Co., Kenosha Pass (CSU); Saguache Co., Saguache (CSU). ILLINOIS: Jo Daviess Co., Galena (INHS): Lake Co., Lake Forest (CU). MICHIGAN: Mackinac Co. (MSU); Manistee Co., Manistee



FIGURES 204—*N. uliginosa:* distribution map.

(ANSP). MINNESOTA: Cook Co., Grand Marais (UMN), Marais (UMN); Marshall Co. (UMN). MONTANA: Flathead Co., 1.6 km W Bigfork (KSU, USNM), 12.9 km S West Glacier (KSU); Glacier Co., 3.2 km E Babb (KSU, USNM), NW Browning (KSU, USNM); Lake Co., 3.7 km E.) Bigfork (WNM), Dayton (ANSP), 32.2 km S Swan Lake (KSU). NEW MEXICO: Sandoval Co., Jemez Springs (ANSP). OREGON: Benton Co., 19.3 km S Corvallis-McFadden Pond (WNM); Grant Co., 0.8 km S Senaca (WNM); Harney Co., 25.8 km N Burns (WNM), 3.2 km E Burns (WNM), S shore Harney Lake (WNM); Klamath Co., Aspen Lake (WNM); Lake Co., Ana Reservoir (WNM), 6.9 km NW Paisley (WNM), 7.7 km N Summer Lake (WNM), Warner Canyon (WNM); Linn Co., 33.8 km SE Idanha (WNM); Wheeler Co., 29.8 km E Mitchell (WNM). SOUTH DAKOTA: Custer Co., 11.3 km W Custer (WNM), Flynn Creek 12.9 km N Pringle (CNC); Grant Co., Big Stone City (USNM); Meade Co., Piedmont (KU); Stanley Co., Fort Pierre (ANSP). UTAH: Utah Co., Provo Canyon (UMN). VERMONT: Windham Co., Jacksonville-Laurel Lake (UMN). WASHINGTON: Grant Co., Grand Coulee-Columbia River (WSU); Ferry Co., 24.2 km W Kettle Falls (UN, USNM); Spokane Co., Liberty Lake (USNM); Whitman Co., Johnson (WSU)

GEOGRAPHIC DISTRIBUTION (Figure 204).—*Notiphila uliginosa* is distributed primarily in the West, where it is found as far north as Alaska, Yukon Territory, and the Northwest Territories and eastward as far as Vermont. Collection dates are from 15 May to 28 August.

REMARKS.—*N. uliginosa* is a variable species in the Neararctic Region. In Oregon, California, and Utah, populations of this species are considerably darker, appearing melanic, whereas populations from northern Washington, Montana, South Dakota, and Canada are much lighter in color. The color of the hind tarsi in particular tends to vary.

Populations of the lighter morph are also divisible into two groups. Specimens from states or provinces surrounding the Great Lakes are extremely similar to those from localities found farther to the west, but the apical end of the hypandrial process of these specimens usually differs in shape. The distal end of the preapical enlargement is squared off and in some cases there is a distinct "step" before the more typical rounding of the enlargement. The expression of this character, however, is not constant, and considerable variation is evident. I have not examined specimens from enough localities to determine whether this variation is clinal, although I suspect it is.

The dark color morph and both groups of the lighter morph could represent distinct species. The evidence at hand is not sufficient to properly assess this possibility. More specimens from localities between the somewhat isolated collection sites of each morph will be necessary in order to evaluate the extent and degree of variation. I have not studied specimens of the different morphs that occur sympatrically.

This species has been collected from a wide variety of environmental conditions. Specimens have been collected from along the shores of an alkaline lake, from emergent vegetation in shallow reservoirs, and from the margins of mountain streams.

Species Inquirenda

Notiphila (Notiphila) latelimbata Curran

Notiphila latelimbata Curran, 1930:77.

TYPE-MATERIAL.—Holotype famale: "F.5061, Sta. Study Insects, Tuxedo, N. Y. 29 · VI · 1928/Collector, C. H. Curran/Notiphila latelimbata Curran TypE (sic), ♀ (red)." The type is deposited in the American Museum of Natural History, New York.

REMARKS.—The type of *N. latelimbata* is very similar to specimens of *N. bella* and it may prove to be conspecific with it. I am deferring placement of this species for the following reasons: (1) no males of *N. latelimbata* are available; (2) very few specimens of *N. latelimbata* or *N. bella* are available; and (3) the extent of variation of *N. bella* or *N. latelimbata* has not been evaluated nor can be until more material is available.

Notiphila (Notiphila?) riparia Meigen

Notiphila riparia Meigen, 1830:65.

TYPE-MATERIAL.—Two syntype specimens, sex unknown. Specimen 1: both antennae broken; some tarsi also broken; abdomen destroyed by dermestids; four dorsal extensor bristles on middle tibia. Specimen 2: badly damaged on the whole; head and antennae still in good condition; left middle tibia with three dorsal extensor bristles (right leg missing); abdomen destroyed. The syntypes are in the Museum National d'Histoire Naturelle, Paris, type number 2434 in Meigen's collection. The collecting locality of these specimens is not known but presumably is somewhere in Europe.

REMARKS.—The information above was provided by Dr. Loïc Matile (pers. comm.), who compared

Meigen's syntypes with two North American specimens that represent what North American authors have been considering as *N. riparia.* From Dr. Matile's notes, I suspect that each of the syntypes represents a separate species. The first specimen could be a member of the subgenus *Dichaeta,* as it has four dorsal extensor bristles on the middle tibia. I have examined European specimens that were identified as *N. riparia* and also compared photographs and drawings of the male terminalia of what Dahl (1959, 1972) treated as *N. riparia. Notiphila riparia* of these European authors is not the same species that occurs in North America, nor have I examined any specimens of *N. riparia* of North American authors that is comparable with any European species. Based on this evidence, I have described *N. riparia* of American authors as a new species, *N. pulchra.*

Whether *N. riparia* Meigen occurs in North America will depend on a clarification of its identity.

Phylogeny and Classification

General Considerations

The phylogeny and classification presented here are based on species occurring in the Nearctic Region and lack the comprehensive purview of a worldwide study. Nevertheless, I examined many extralimital species and extracted pertinent information from available literature for testing before the final collation presented herein was outlined. Cresson's publications (1917, 1946) and the more recent study of Cogan (1968) were especially important. Although valid only for the Nearctic fauna, the basic argumentation scheme presented here should have universal application.

An overview of the tribe Notiphilini will provide perspective on classification and phylogeny of *Notiphila,* the nominate genus of the tribe. In addition to *Notiphila,* the tribe contains four other genera: *Dryxo* Robineau-Desvoidy, *Karema* Cresson, *Oedenops* Becker, and *Paralimna* Loew. When Cresson (1946:228) erected Notiphilini, he included five genera: *Dichaeta, Notiphila, Oedenops, Paralimna,* and *Typopsilopa* Cresson. In the same work (page 239), Cresson erected a new tribe, Typopsilopini, for *Typopsilopa.* Cogan (1968) later defined Notiphilini to include the genera *Karema* and *Dryxo,* although Wirth (1956) had placed both of these in the subfamily Notiphilinae without assigning them to a tribe. I accept Cogan's definition of Notiphilini with the minor changes and additions stated in my diagnosis of the tribe.

In the following discussion, each character state is assigned a number corresponding to that on the cladogram (Figure 207). The discussion is supplemental to the cladogram.

Tribe NOTIPHILINI

The monophyly of Notiphilini is evidenced by the following apotypic character states (unless stated otherwise, the relative apotypic versus plesiotypic state was determined by ex-group comparison):

1. One to four (rarely five) conspicuous, usually dorsal-erect bristles toward the base of the middle tibia. If only one bristle is present, it is inserted basally; if up to four bristles are present, these are spaced along the dorsum of the tibia to its apex.

2. Paravertical bristles present, usually well developed (I adopt Steyskal's (1976) terminology for these bristles). Some members of the tribe lack well-developed paravertical bristles, a condition I interpret as a secondary development. Although these bristles are reduced in some instances, they remain discernible from surrounding setae.

3. Abdominal terga fasciated along anterior margins. Like the paravertical bristles, this character state is obscured in specimens of some species by secondary developments such as in the uniformly-colored terga of specimens of *Oedenops* or the guttate markings in specimens of some *Notiphila* (sensu stricto) species.

Genus *Notiphila*

Within the tribe, the first major dichotomy is differentiation of the *Notiphila* lineage, including *Dichaeta. Notiphila* is distinguished from its sister-group, and its monophyly is indicated by the following apotypic states:

4. Costal vein short, extending to tip of vein R_{4+5}. This condition is unique within the tribe and generally throughout the family. Exceptions within the family (convergence) are *Scatophila* Becker (Ephydrinae) and *Axysta* Curtis (Parydrinae).

5. Dorsum of middle tibia with four, usually dorsal-erect, large setae, arranged 3, 1 (3 along dorsum plus one apical). I interpret this condition to be apotypic based on within-group trends. The common condition in other genera of the tribe is three setae, arranged 2, 1.

Notiphila and *Dichaeta* have traditionally been maintained as separate genera (see brief review above). Recognition of *Dichaeta* as a distinct genus, however, would render *Notiphila* paraphyletic. Consequently, I have included the species otherwise placed in *Dichaeta* under *Notiphila* as the *caudata* group, and the name *Dichaeta* becomes the senior synonym for one of the subgenera, replacing *Agrolimna* Cresson.

The validity of *Dichaeta* as a genus distinct from *Notiphila* was questioned by Cresson (1917), who discovered that males of *N. furcata* and *N. bispinosa* possess the distinguishing character states of *Dichaeta*. These *Notiphila* species both have the fifth abdominal tergum produced into a *Dichaeta*-like process that bears one to three stout bristles, and the posterior margin of the fourth tergum bearing a row of bristles that are distinctly larger than comparable bristles on preceding segments. Although Cresson continued to recognize *Dichaeta* as a genus, he con-

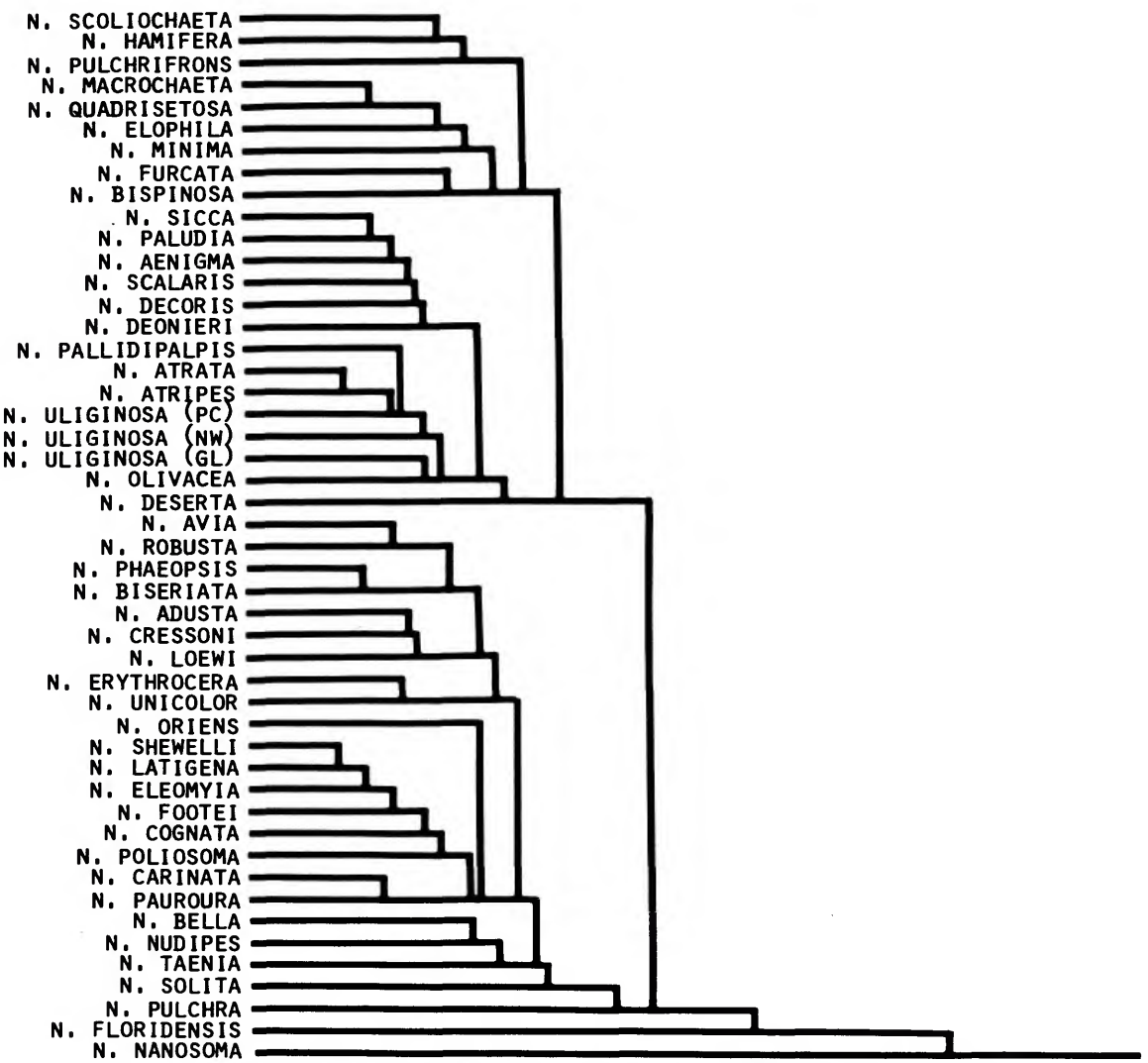


FIGURE 205.—Phenogram of 46 species of *Notiphila* based on unweighted pair-group method using arithmetic averages cluster analysis of Manhattan distance coefficients. The cophenetic correlation coefficient was 0.84.

cluded that *Dichaeta* (1917:26, 68 respectively), ". . . is not an altogether satisfactory genus . . ." and "the validity of *Dichaeta* as a distinct genus is somewhat doubtful."

Subgenera *Notiphila* and *Dichaeta*

After differentiation of the *Notiphila* lineage, another dichotomy gave rise to the subgenera *Notiphila* and *Dichaeta*. This dichotomy is indicated partially by cladistic and partially by phenetic analysis. Clustering of data from the distance coefficient matrix had higher cophenetic values and also demonstrated the subgeneric split better than comparable clustering based on data from the correlation coefficient matrix. Cophenetic values, however, were comparatively low in all cases, indicating considerable distortion by the clustering techniques. The highest cophenetic values resulted from an unweighted pair-group method using arithmetic averages (UPGMA) clusterings of data from Manhattan and Euclidean distance coefficient matrices. The phenograms of these clusterings are shown in Figures 205–206.

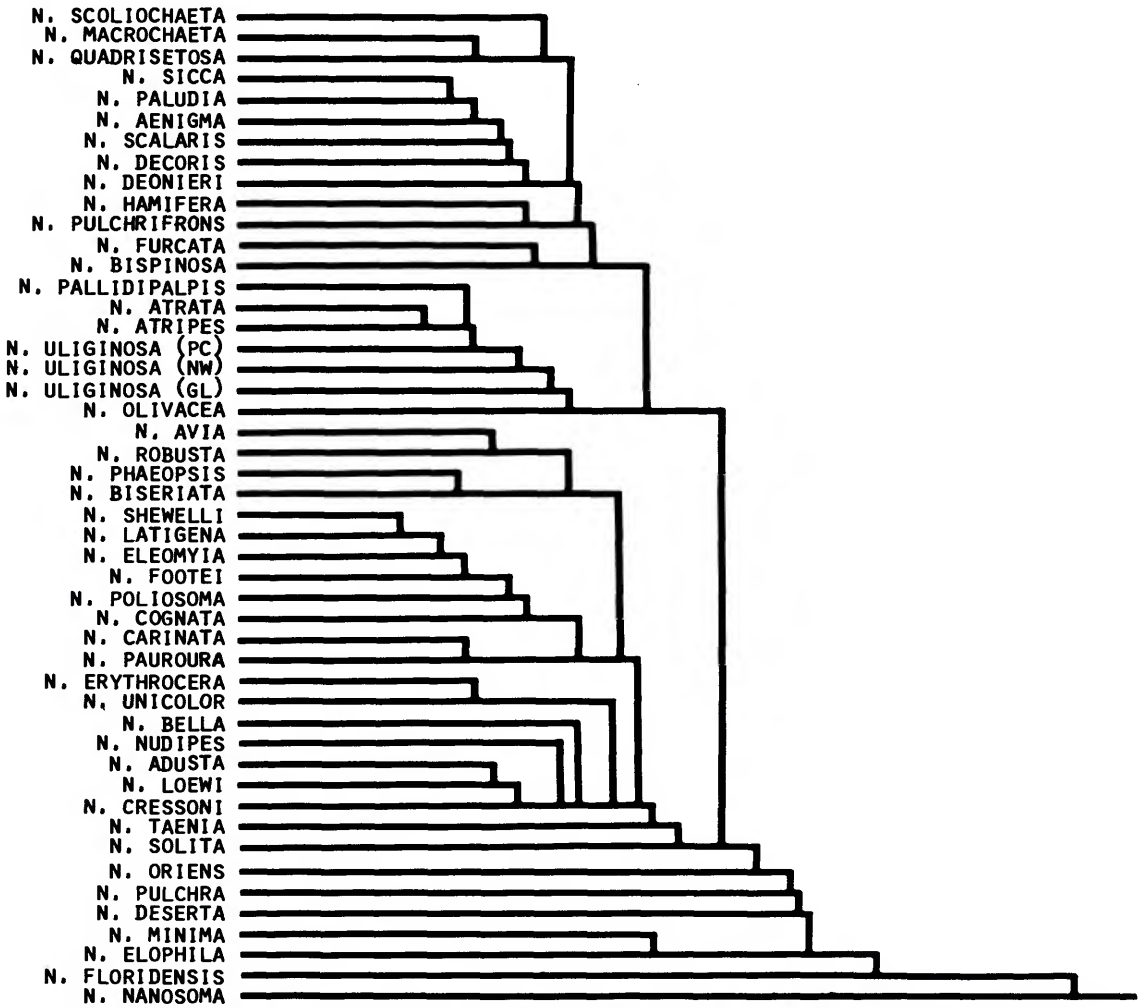


Figure 206.—Phenogram of 46 species of *Notiphila* based on unweighted pair-group method using arithmetic averages cluster analysis of average Euclidean distance coefficients. The cophenetic correlation coefficient was 0.86.

Apotypic character states indicating the monophyly of the subgenus *Notiphila* are:

6. Setal fascicle of hind basitarsus at least partially black. In other *Notiphila*, these setae are pale, usually yellowish.

7. Hypandrial receptacle unsclerotized except for two narrow, lateral bands. Within the tribe, the hypandrial receptacle is a well-sclerotized, flat structure; the reduced sclerotization is apparently unique to this subgenus.

8. Number of proclinate, fronto-orbital setae reduced to at most one pair, frequently none is present. Notiphilines generally have two pair.

9. Operculum of the female ventral receptacle as wide as high. In other genera of the tribe, the operculum is much higher than wide.

10. Middle femur with row of closely-set setae along postero-ventral margin. In most Notiphilini, these setae are either weak or lacking.

Apotypic character states indicating the monophyly of the subgenus *Dichaeta* are:

11. Respiratory tube of larva and puparium over one-half body length. The respiratory tube in known cases is generally less than one-half the body length.

12. Hypandrial receptacle bowl-shaped. In most Ephydridae, this structure is flat or shallowly curved.

13. Surstylus long and with preapical, posterior enlargement (see Figures under each species).

Species Groups

Below the subgeneric level, clusters of related and usually similar species may also be recognized. For *Notiphila*, these are arranged in species groups following the precedent of Cresson (1917).

Subgenus *Notiphila*.—I recognize three species-groups for the subgenus *Notiphila*. Cresson (1917) recognized two, characterized by presence or absence of a ciliate row of small setae along the venter of the middle tibia. His *riparia*-group is essentially unchanged in this study, but I have divided his *cinerea*-group into two groups.

I call the equivalent of Cresson's *riparia*-group the *avia* group. The epithet *avia* is used rather than *riparia* because *N. riparia* probably does not occur in the Western Hemisphere. Although only five North American species are in the *avia* group, it is as heterogeneous as either of the other species-groups of this subgenus. This is evident in the phenetic analysis, in which only *N. avia* and *N. robusta* consistently cluster together (Figures 205–206, 208). *Notiphila erythrocera* is provisionally placed here, although this species probably belongs in a group of as yet uncharacterized Neotropical species. Apotypic character states distinguishing the *avia* group are:

14. Overall size large. Specimens of this species-group are among the largest of the genus.

15. Facial setae well developed, bristlelike. Throughout most of the tribe, facial setae are smaller, hairlike.

The sister-group of the *avia* group is the lineage giving rise to the *adusta* and *loewi* groups. The indication of the monophyly of this lineage is:

16. Hypandrial process elongate, considerably longer than wide. In males of the *avia* group and in general throughout the tribe, the hypandrial process is short.

The *adusta* group includes eight species. Three of these, *N. bella*, *N. taenia*, and *N. nudipes*, form a recognizable subgroup. Members of this subgroup have vittate markings on the mesonotum, and the sides of the scutellum are dark, contrasting distinctly with the lighter-colored dorsum. They also form a grouping in the phenetic treatment based on clustering of Manhattan distance coefficients (Figure 208). The species-group is characterized by the following apotypic character states:

17. Hypandrium process greatly enlarged.

18. Hypandrium process, particularly the apex, invested with spinules.

The sister-group of the *adusta* group appears to be the *loewi* group. The *loewi* group numbers 12 species at present and is the largest species-group of the subgenus in North America. Three subgroups are evident based on similarities of the male genitalia. The phenetic analysis did not result in any clusterings that could be characterized conveniently (Figure 208). Specimens of *N. solita* and *N. paurosoma* are externally similar to each other and together they resemble many specimens of species related to *N. taenia* of the *adusta* group. The dark sides of the scutellum is a character state common to all of these species. A second subgroup is *N. floridensis*, specimens of which bear many similarities to those of *N. cognata* of the *adusta* group; these species were once considered conspecific. Based on similarity, the remaining species of the group appear to be closely related, with the possible exception of *N. oriens*, which is somewhat similar to *N. erythrocera* of the *avia* group. The *loewi*

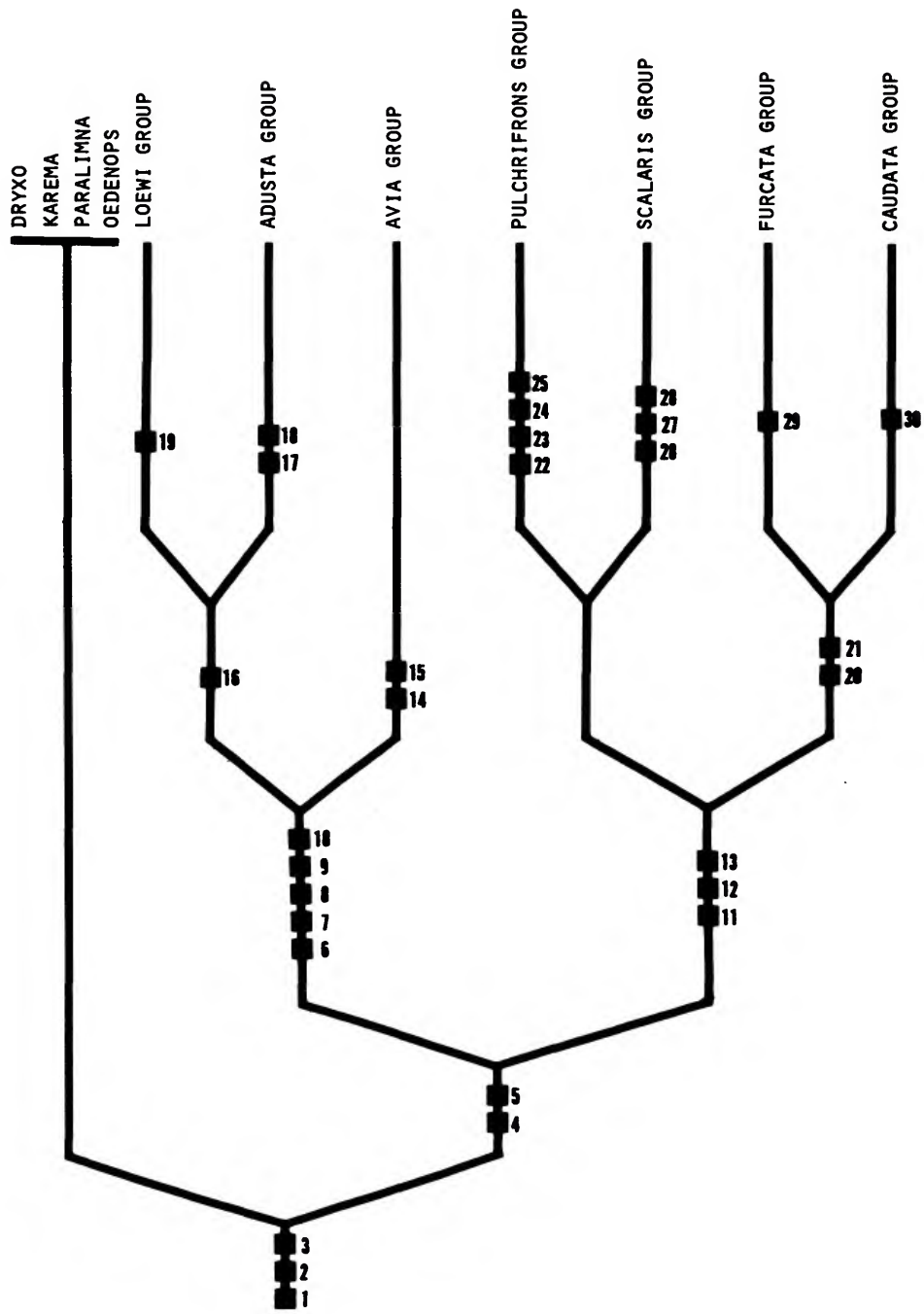


FIGURE 207.—Cladogram of the genus *Notiphila*, including subgenera and species-groups. Numbered black squares correspond with numbered, apotypic character states listed in the text.

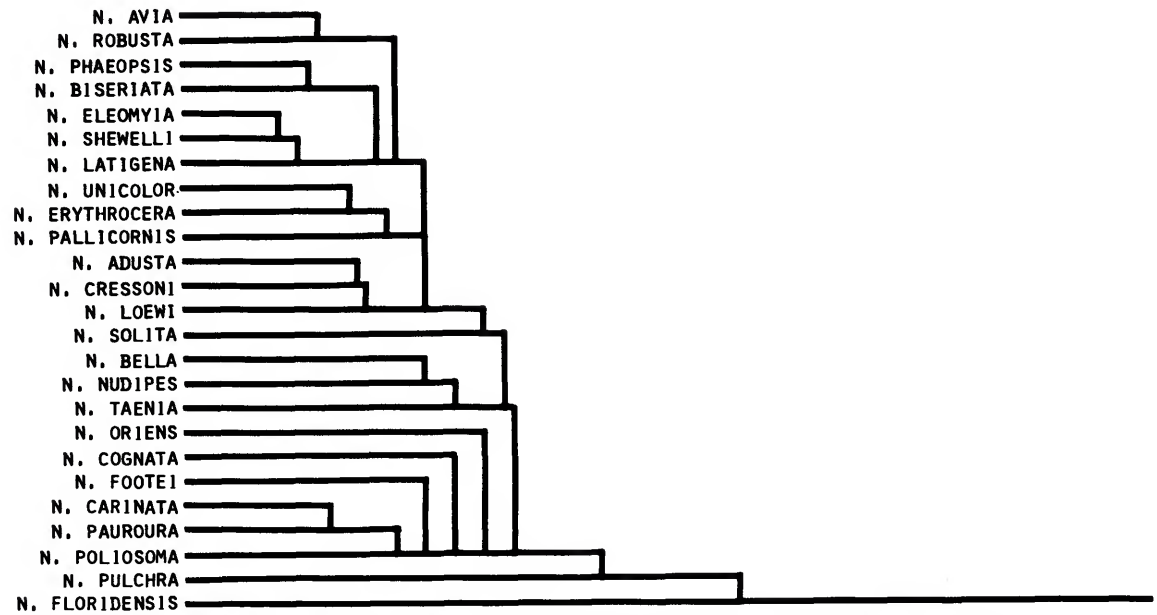


FIGURE 208.—Phenogram of 25 species of subgenus *Notiphila* based on weighted pair-group method using arithmetic averages cluster analysis of Manhattan distance coefficients. The cophenetic correlation coefficient was 0.80.

group is characterized by the following apotypic character state:

19. Hypandrial process narrow, bearing two to three apical setae. This combination appears to be unique to specimens of this species-group.

SUBGENUS *Dichaeta*.—Four species-groups are recognized within the subgenus *Dichaeta*. The phenetic analysis also indicated these groups as clusters (the *caudata* group was not considered when the analysis was performed).

In the cladogram (Figure 207), I indicate two primary lineages of the subgenus *Dichaeta*, each giving rise to two species-groups. Only one of these, the *furcata-caudata* lineage, is characterized by apotypic character states. The *pulchrifrons-scalaris* lineage is based on what are apparently plesiotypic character states and could be paraphyletic. The monophyly of the *furcata-caudata* lineage is indicated by two apotypic character states:

20. Fifth abdominal tergum of male produced into a slender process that bears stout, apical setae. This tergal conformation is unique to males of the *furcata* and *caudata* species-groups.

21. Posterior margin of fourth and fifth abdominal terga of males with enlarged setae, three to four times the size of those on preceding terga.

The *pulchrifrons* group includes three North American species, *N. pulchrifrons*, *N. hamifera*, and *N. scoliochaeta*. These species form an easily-recognized group in terms of their morphology and distribution (see appropriate taxonomic section). In the phenetic analysis, this species-group clustered best using UPGMA on the matrix of Manhattan distance coefficients (Figure 209). Apotypic character states indicating the monophyly of the *pulchrifrons* group are:

22. Hypandrial receptacle as two half-circle plates. (See character state 7 for plesiotypic condition.)

23. Surstylus uniquely shaped (see Figures 106–116, 122).

24. Parafrons velvety. Generally, the vestiture of this structure is pollinose.

25. Ventral margin of epandrium extended, usually into two symmetrical processes. Males of other species of this subgenus have the ventral margin of the epandrium truncate or bluntly rounded.

The largest species-group of this subgenus is the *scalaris* group, numbering 17 species. Most of these

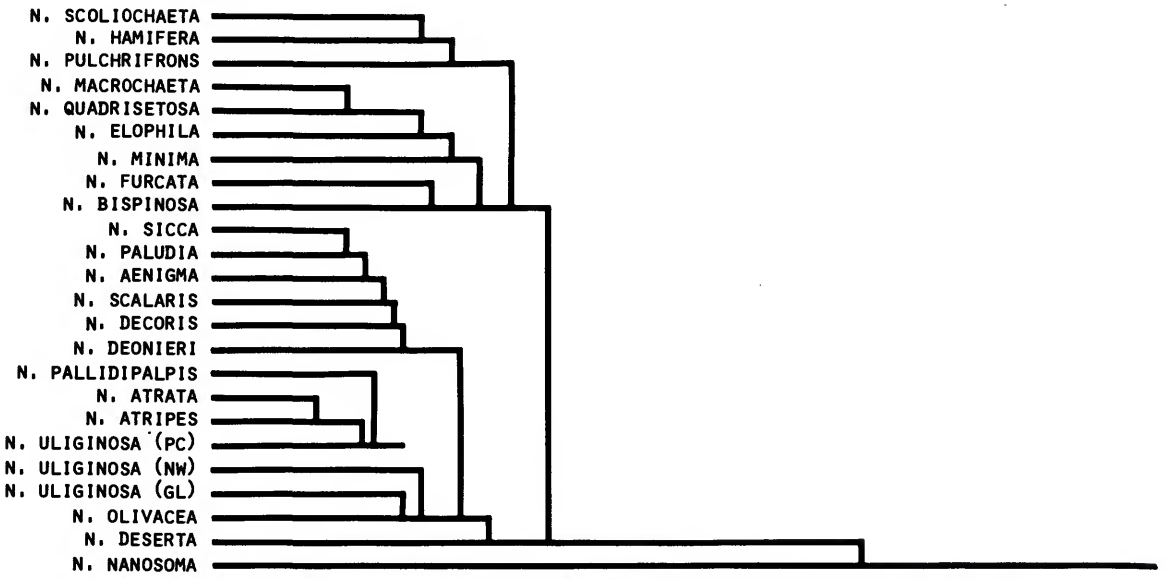


FIGURE 209.—Phenogram of 22 species of the subgenus *Dichaeta* based on unweighted pair-group method using arithmetic average clustering analysis of Manhattan distance coefficients. The cophenetic correlation coefficient was 0.87.

are very similar to each other. This is substantiated by the phenetic analysis in which most of the included species cluster together (Figure 210). The monophyly of the *scalaris* group is indicated by the following apotypic character states:

26. Hypandrial receptacle deeply cup-shaped. (See character state 7 for description of plesiotypic condition.)

27. Maxillary palpus dark, blackish brown to black. The plesiotypic condition throughout the tribe is maxillary palpus pale, mostly yellowish.

28. Antennal segments dark, mostly black. Within the tribe, the plesiotypic condition is at least one antennal segment with some pale coloration.

The *furcata* group contains two Nearctic species, *N. furcata* and *N. bispinosa*. These two species are consistently grouped by various clustering methods on matrices of both Euclidean and Manhattan distance coefficients (Figures 209–210). A Japanese species *N. sekiyai* Koizumi, may also belong to this group based on Miyagi's description (1966, 1977). The only apotypic character state I found to indicate the monophyly of this group is:

29. Immature stages adapted to brackish-water. These are the only species of the tribe that are found almost exclusively in brackish-water.

Species of the *caudata* group were not included in the phenetic analysis, and part II of the present series is intended to be a revision of them. An apotypic character state indicating the monophyly of the *caudata* group is:

30. Overall coloration dark. The majority of *Notiphila* species are light-colored.

Zoogeography

Because this study considers only the Nearctic species of a worldwide fauna, the contents of this section will be preliminary, primarily descriptive, and brief. Distributional data cited in the taxonomic section will not be repeated here. When other major faunas are revised to a comparable level, a more comprehensive analysis will be possible. Only the recent revision of the Ethiopian fauna presently offers this advantage (Cogan, 1968).

Members of *Notiphila* are found in most temperate and tropical regions of the world (Table 1). Likewise both subgenera are widely distributed, although the number of described species in the subgenus *Notiphila* outnumbers those of *Dichaeta* by a ratio of approximately 2:1.

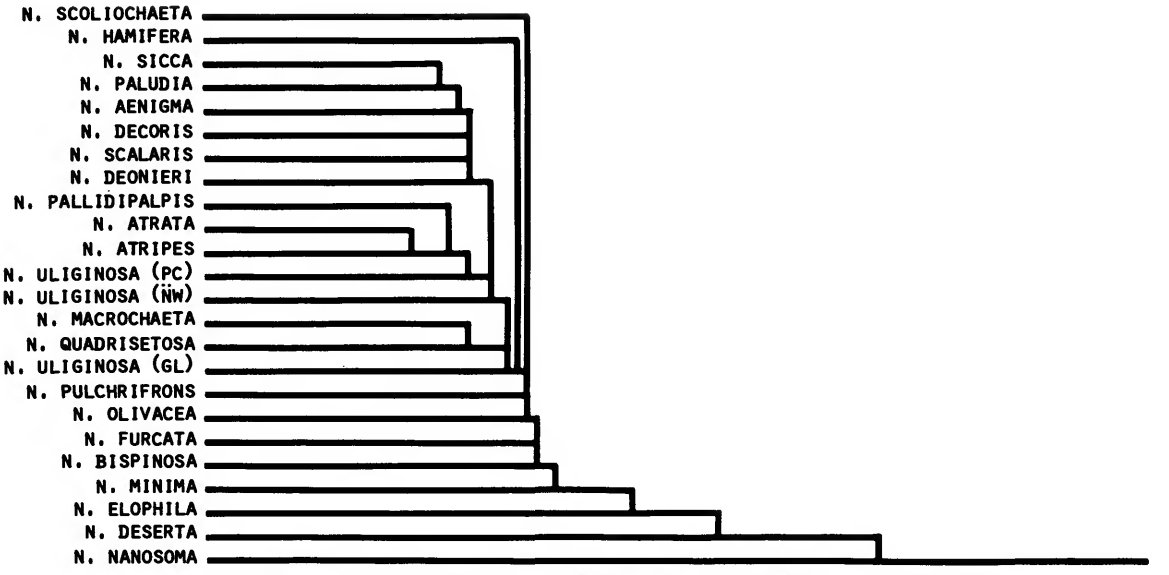


FIGURE 210.—Phenogram of 22 species of the subgenus *Dichaeta* based on complete linkage clustering analysis of average Euclidean distance coefficients. The cophenetic correlation coefficient was 0.87.

Even though the genus is generally widespread, most species are limited in distribution to one zoogeographic region. In North America, for example, 47 species are now recognized, but only four occur in other zoogeographic regions. *Notiphila uliginosa* is Holarctic; *N. furcata, N. pulchrifrons,* and *N. erythrocera* are in the Nearctic and Neotropical regions.

Specimens of most species are apparently quite vagil. Evidence of considerable dispersal is deduced from the overlapping distributions of closely related species. Because known species of *Notiphila* are bisexual and have no host specificity, I assume that speciation occurred in sympatry. Overlapping distributions of closely related species, therefore, is evidence that subsequent dispersal has occurred.

Three generalized observations concerning the distribution of the North American fauna are evident. The subgenus *Notiphila* is primarily eastern; the subgenus *Dichaeta* is mostly western; and there are no records of any *Notiphila* species from northeastern North America north of 50° north latitude. With the exception of *N. erythrocera* and *N. avia,* there are no records of species of this subgenus west of the Rocky Mountains south of 45° north latitude. Above 45°, only *N. footei, N. loewi, N.*

TABLE 1.—Distribution of *Notiphila* species by faunal realm ("Unrecognized species" = previously described but presently unrecognized)

Faunal Realm	Number of species	Subgenus *Notiphila*	Subgenus *Dichaeta*	Unrecognized species	Source of information
Palearctic	28	24	4	10	Becker, 1926; Dahl, 1959, 1972; Miyagi, 1966, 1977
Ethiopian	25	14	11	—	Cogan, 1968
Oriental and Australian	8	7	1	19	Cresson, 1948
Nearctic	50	25	25	2	present study
Neotropical	9	6	3	5	Wirth, 1968b

pallicornis, and *N. shewelli* occur west of the 100th meridian, and three of the latter species range westward along the Canadian-United States border. The fourth, *N. pallicornis,* is known only from the Mackenzie River delta in northern Canada. By far most species of this subgenus range in east central North America, particularly around the Great Lakes and southward. Species of the *adusta* and *loewi* groups are almost exclusively eastern.

As a subgenus, *Dichaeta* has a more balanced North American distribution, but at the species-group level, it appears to be disjunct. The *furcata* group is known to occur only along the eastern and southeastern coasts of the United States; the *pulchrifrons* group does not range north of 40° north latitude in the West or 50° north latitude in the East; the *scalaris* group is primarily western, with only four species, *N. deonieri, N. elophila, N. paludia,* and *N. scalaris* occurring exclusively east of the Rocky Mountains. No species of the *scalaris* group range into the Southeast.

The apparent absence of species in the northeast is probably due to lack of collecting in the area. I feel that species of the *loewi* and *adusta* groups will be discovered with thorough collecting in that area.

Until revisions of the Neotropical and Palearctic faunas are completed, further assessment of the zoogeographic relationships will be of little value. Most of the species from the Neotropical region remain undescribed and based on preliminary studies, I suspect that many species of the Nearctic fauna have close relationships with species of this region.

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Bibliography, depending upon use, is termed "References," "Selected References," or "Literature Cited." Spell out book, journal, and article titles, using initial caps in all major words. For capitalization of titles in foreign languages, follow the national practice of each language. Underline (for italics) book and journal titles. Use the colon-parentheses system for volume/number/page citations: "10(2):5–9." For alinement and arrangement of elements, follow the format of the series for which the manuscript is intended.

Legends for illustrations must not be attached to the art nor included within the text but must be submitted at the end of the manuscript—with as many legends typed, double-spaced, to a page as convenient.

Illustrations must not be included within the manuscript but must be submitted separately as original art (not copies). All illustrations (photographs, line drawings, maps, etc.) can be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively. If several "figures" are treated as components of a single larger figure, they should be designated by lowercase italic letters (underlined in copy) on the illustration, in the legend, and in text references: "Figure 9b." If illustrations are intended to be printed separately on coated stock following the text, they should be termed **Plates** and any components should be lettered as in figures: "Plate 9b." Keys to any symbols within an illustration should appear on the art and not in the legend.

A few points of style: (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled-out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

Arrange and paginate sequentially EVERY sheet of manuscript—including ALL front matter and ALL legends, etc., at the back of the text—in the following order: (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.