

———, and KNIGHT, K. L. 1952. Ecological survey of the mosquitoes of Southern James Bay. *Amer. Mid. Nat.* 47(2):456-8.

NIELSEN, L. T., and REES, D. M. 1961. An identification guide to the mosquitoes of Utah. *Univ. Utah Biological Service* 12(3):1-58.

OWEN, W. B., and GERHARDT, R. W. 1957. The mosquitoes of Wyoming. *U. of Wyoming Pub.* 21(3):71-141.

REMPEL, J. G. 1950. A guide to the mosquito larvae of Western Canada. *Canad. J. Res., D*, 28:207-48.

STAGE, H. H., GJULLIN, C. M., and YATES, W. W. 1952. Mosquitoes of the Northwestern States. *U. S. Dept. Agric. Handbook* 46, 95 pp.

VOCKEROTH, J. R. 1954. Notes on the identities and distribution of *Aedes* species of Northern Canada, with a key to the females (Diptera: Culicidae). *Canad. Entomol.* 86(6):241-55.

YAMAGUTI, S., and LACASSE, W. J. 1951. Mosquito fauna of North America. Part V. Office of the Surgeon, Hq. Japan Logistical Command, APO 343, 265 pp.

## NOTES ON THE *CULICOIDES* OF NEW JERSEY<sup>1</sup>

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High populations of *Culicoides* species occur in areas of New Jersey where large numbers (i.e., 500-700) of white-tailed deer died in 1955 from a fatal virus disease designated by Shope *et al.* (1960) as epizootic hemorrhagic disease (EHD). Preliminary work (Shope *et al.*, 1955) suggested that the virus may be carried by an arthropod rather than transmitted by direct contact. Because the biting midges of the genus *Culicoides* are involved in the transmission of disease agents (Foote & Pratt, 1954) an attempt was made to identify the *Culicoides* fauna in these areas of the State. Cooperative studies were also undertaken in 1956 between the Rutgers Entomology Department, Dr. Shope of the Rockefeller Institute, and the New Jersey Division of Fish and Game. These included attempts at virus transmission by injecting deer with suspensions of wild-caught *Culicoides* specimens (unpublished data) and preliminary transmission experiments

(Shope *et al.*, 1960) with the stable fly (*Stomoxys calcitrans*) and mosquitoes (*Culex pipiens* and *Aedes vexans*). While not conclusive, these studies failed to produce any positive evidence of arthropod involvement.

In addition to *Culicoides* spp. being serious nuisance pests there is also the possibility that they are involved in the transmission of the virus causing eastern encephalitis (EE) which occurs almost annually in New Jersey (Burbutis and Jobbins, 1957) among birds. This virus has been isolated from wild-caught *Culicoides* species in the Southeastern United States (Karstad *et al.*, 1957). However, their role as vectors of the virus among birds, horses, or other animals is still not defined.

To date only six species of *Culicoides* have been reported from New Jersey.

RESULTS. Table 1 lists the *Culicoides* species found during this study and the collection localities. All the species reported here were collected during August and September of 1956 by means of conventional New Jersey mosquito light traps. The traps were operated at a height of approximately 5 feet above ground level.

Thirteen species of *Culicoides* were found in these light trap collections. Nine of them, as indicated in the table, are new records for the State. The remain-

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TABLE 1.—New Jersey *Culicoides* species and collection localities, August-September, 1956.

Species <sup>1</sup>	Localities
<i>Culicoides baueri</i> Hoffman *	Jockey Hollow
" <i>biguttatus</i> (Coq.) *	" "
" <i>crepuscularis</i> Malloch	" "
" <i>furens</i> (Pocoy)	Madison Pittstown Estelle Manor Salem
" <i>guttipennis</i> (Coq.)	Pittstown Jockey Hollow
" <i>melleus</i> (Coq.) *	" "
" <i>obsoleus</i> (Mg.)	" "
" <i>sanguisuga</i> (Coq.) *	Pittstown " "
" <i>spinosus</i> R. & H. *	Jockey Hollow " "
" <i>stellifer</i> (Coq.) *	" "
" <i>testudinalis</i> Wirth & Herbert *	Pittstown " "
" <i>venustus</i> Hoffman *	" "
" <i>villosipennis</i> R. & H. *	Jockey Hollow " "

<sup>1</sup> Species identifications were all confirmed and/or determined by Dr. W. W. Wirth, 1963.

\* New State records.

ing four species have been reported previously from New Jersey. *C. hollensis* (= *canithorax*) and *C. variipennis* also

have been reported from New Jersey but were not found during the course of this study. Including these last two species, the *Culicoides* faunal list of New Jersey now numbers 15. However, there remain thousands of sorted specimens of *Culicoides* to be identified, and the possibility of more species being added to the list is excellent.

#### References Cited

- BURBUTIS, P. P., and JOBBINS, D. M. 1957. *Culiseta melanura* Coq. and eastern equine encephalomyelitis in New Jersey. Proc. 44th. Ann. Meet. N. J. Mosq. Extrem. Assoc. 68-78.
- KARSTAD, L. H., FLETCHER, O. K., SPALATIN, J., ROBERTS, R., and HANSON, R. P. 1957. Eastern equine encephalitis virus from three species of Diptera from Georgia. Science 125: 395-396.
- FOOTE, R. H., and PRATT, H. D. 1954. The *Culicoides* of the Eastern United States (Diptera, Heleidae). Public Health Monog. 18:1-53.
- SHOPE, R. E., MACNAMARA, L. G., and MANGOLD, R. 1955. Deer mortality/epizootic hemorrhagic disease of deer. N. J. Outdoors 6(5):16-21.
- Ibid.* 1960. A virus-induced epizootic hemorrhagic disease of the Virginia white-tailed deer (*Odocoileus virginianus*). J. Exp. Med. 111(2): 155-170.