size and proportions, they appear not to belong to any of the 3 other known Cuban species of *Mexobisium*. However, it seems unwise to describe them as new at this time.

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I am greatly indebted to Dr. Armas for sending me the pseudoscorpions from Cuba, and to Charlotte H. Alteri for preparing the illustrations.

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A NEW SPECIES OF *MACROPEZA* (DIPTERA: CERATOPOGONIDAE) WITH BIOLOGICAL NOTES ON THE GENUS

WALTER I. KNAUSENBERGER[1] AND WILLIS W. WIRTH[2]

ABSTRACT

Detailed descriptions are given for a new species of biting midge from Virginia, *Macropeza pamunkeiana* Knausenberger and Wirth, together with comparative notes on *M. blantoni* Wirth and Ratanaworabhan, the only other known speices of the genus in the Western Hemisphere. The new species appears to prefer small stream environments, and has austral affinities. Notes on the known biology of the genus are provided.

In connection with studies on the biosystematics of biting midges, the authors examined benthic and light trap samples taken during continuing, long-term research by colleagues on the river-reservoir ecosystem of the North Anna River in the Piedmont of Virginia (Simmons and Voshell 1978). Two light trap samples yielded specimens of an interesting new species of *Macropeza* Meigen, a genus in the tribe Sphaeromiini, closely related to *Probezzia* Kieffer. Until recently, *Macropeza* was not known to occur in North America (Wirth and Ratanaworabhan 1972). Indeed, the immature stages of most Sphaeromiini remain almost completely undescribed, despite

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the fact that they can be common in benthic samples (personal observations). Usually, discrimination of the immature forms must be preceded by an understanding of adult taxonomy. In this context, the following adult descriptions are offered together with detailed biological notes.

A complete diagnosis and restriction of the genus *Macropeza* are provided in the paper by Wirth and Ratanaworabhan (1972). General ceratopogonid morphological terminology is given by Wirth et al. (1977). A useful treatment of female genitalia is presented by Saether (1977). The following special terms are used in the descriptions: ES, eye separation, is a ratio obtained by dividing the distance between the closest approach of the eyes by the diameter of a typical adjacent facet. The costal extension, CE, is the extension, in mm, of the costa and R4+5 beyond the apex of the radial cell of the wing (Fig. 1m, n). LR, the leg ratio, is obtained by dividing the length of the tibia into the length of the basitarsus (ta_1/ti); TR, tarsal ratio, is the division of the second tarsomere length into that of the basitarsus (ta_1/ta_2). The "brushlet" in the descriptions is a tiny movable structure nestled among a dense brush of setae at the apex of the hind tibia. In the genitalia (Fig. 3), *Gp* refers to the gonopophysis lobes on sternum VIII which bear the conspicuous ventral hair tufts, and *Csa* refers to the coxosternapodemes (on sternum IX near the gonopore) (Saether 1977), generally and less precisely termed "genital sclerotizations." Spermathecal dimensions are reported as: maximum width by maximum length, including neck.

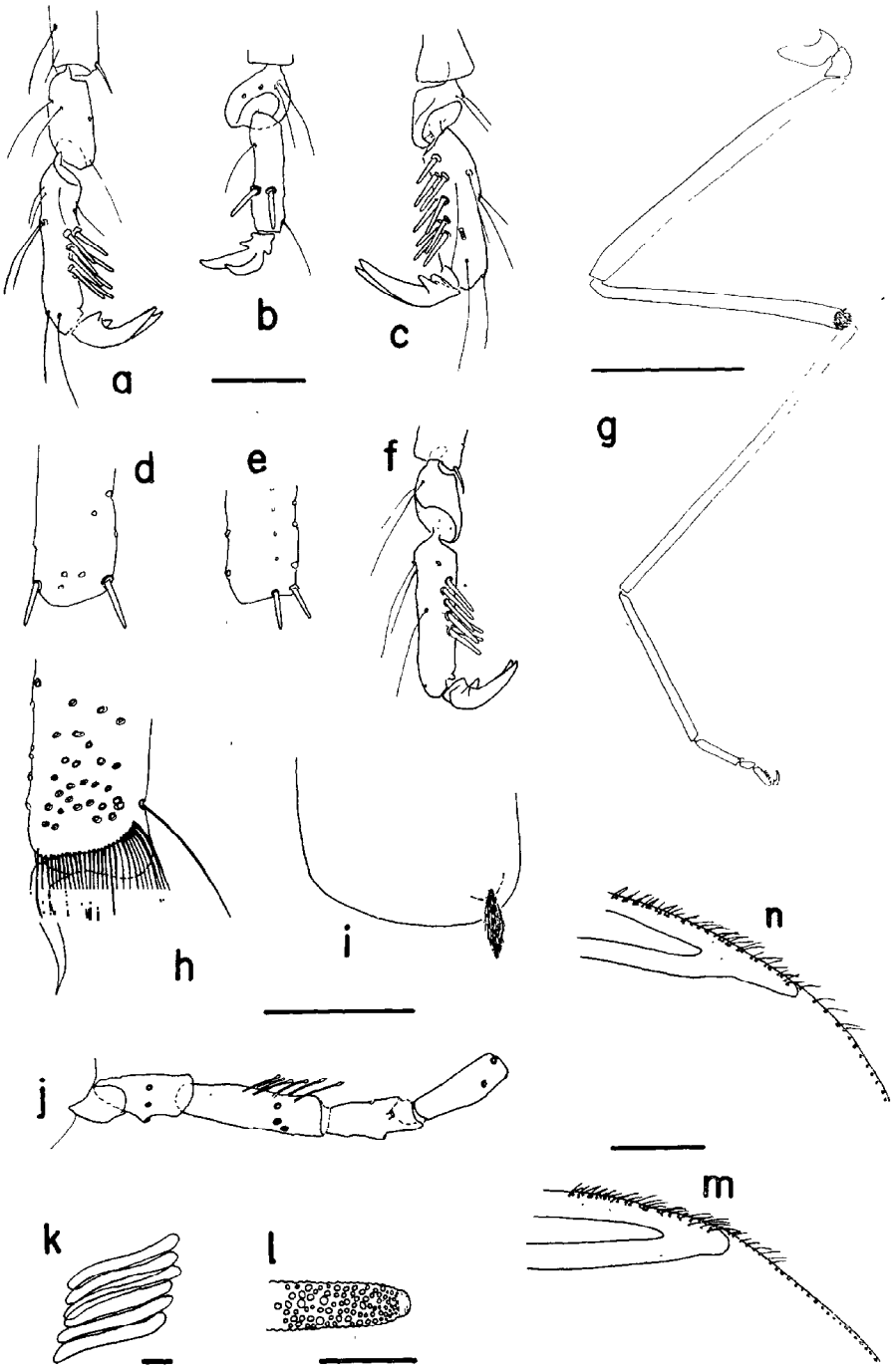
Measurements are presented, when possible, in the following manner: mean value (minimum value—maximum value, s = sample standard deviation, n = number of specimens in sample measured) (n given only if sample size other than 6). Proportions given are mean values (from 6 specimens) rounded to the nearest whole number, of the longitudinal lengths of the antennal flagellomeres (AP), palpal segments (PP), or leg segments. The AP values can be converted to mm by multiplying the values by 0.004; the PP, by 0.0025; the leg proportions, by 0.02.

Macropeza pamunkeiana Knausenberger and Wirth, NEW SPECIES

(Fig. 1a-e, g, h-m; 2)

DIAGNOSIS. A large black species best identified by its greatly elongated hind basitarsus, 1.36 x as long as the hind tibia, compared with *M. blantoni*, in which the hind basitarsus and tibia are about equal in length. *Macropeza pamunkeiana* is consistently the larger of the 2 species, in all characters

Fig. 1. *Macropeza pamunkeiana* Knausenberger and Wirth: a-e, g-j, m, female; k, l, eggs; *M. blantoni*, f, n, female. Claws, 5th, 4th, and apex of 3rd tarsomeres of, respectively, (a, f) meta- (b) meso-; and (c) prothoracic legs. (d) Spines at apex of 1st tarsomere of mesothoracic leg (ventral view). (e) Spines at apex of 2nd tarsomere of meso- thoracic leg (oblique lateral view). (g) Entire metathoracic leg. (h) Spine and comb at apex of prothoracic leg. (i) "Brushlet" at apex of metathoracic tibia (bristles omitted for clarity). (j) Maxillary palpus. (k) Eggs, 50 x. (l) Egg detail, 160 x. (m, n) Costa and R4+5 at apex of wing (CE). Solid horizontal bars indicate 0.1 mm, except in g, where the bar indicates 1.0 mm. Fig. a-f, m, n at same scale; Fig. h-j at same scale.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except the eggs, which are longer in *M. blantoni.* Further distinguishing characters are found in the prominent development of the apical brush of the hind tibia of *pamunkeiana* (less prominent in *blantoni*), the short, cylindrical, hind 4th tarsomere of *pamunkeiana* (cordiform in *blantoni*); costal extension shorter in *pamunkeiana* (0.065 mm) than *blantoni* (0.110 mm), and fewer palpal sensilla (5-7) than in *blantoni* (9-10). Leg armature differs further in that *pamunkeiana* lacks the 2 apical spines on the hind basitarsus, and the apical pseudospurs on mid tarsomere 3 and hind tarsomere 2, found in *blantoni.* Ventral spines are absent in both species.

FEMALE. Wing length 3.51 mm (3.40-3.55, s = 0.052, n = 7); breadth 0.98 mm (0.92-1.01, s = 0.036). Color uniformly dark brown to black, except pleural membranes of abdomen grayish brown to reddish gray.

Head: Dark brown, including antenna and palpus. Eyes bare; color black in alcohol with metallic greenish-blue sheen; well-separated above antennal scape, ES = 3.13 (2.42-4.17, s = 0.659). Antenna 2.07 mm long (2.00-2.12, s = 0.050), flagellomeres cylindrical, distal 5 elongated; antennal hairs apparently not differentiated significantly; AP 44-24-24-24-24-23-24-26-48-51-53-67-86; AR 1.46 (1.38-1.52, s = 0.062). Maxillary palpus (Fig. 1j) with segments subcylindrical (except first), PP 15-26-43-23-30 (n = 9); 3rd segment slender, PR 4.10 (3.95-4.20, s = 0.109, n = 9), inner side bearing 5 (n = 2), 6 (n = 3), or 7 (n = 3) delicate sensilla with sub-bulbous and hastate tips. Mandible with 12 teeth (usually 9 strong and 3 slender); outer margin of blade with 7-10 acute, ventrally-directed notches (n = 4). Maxilla with 14 (n = 1) to 16 (n = 1) serrations per side. Hypopharynx membranous, distally bearing 10-11 sharp-tipped conical projections.

Thorax: Uniformly dark brown; mesonotum somewhat conically produced anteriorly, rounded mesally; sparse vestiture of moderately long (0.070-0.090 mm), erect setae in 4 roughly parallel rows, 12-15 setae per row; scutellum with 8-10 primary setae. Wing similar to that of *M. blantoni;* slender, with narrowly rounded tip, membrane uniformly and faintly brownish infuscated, anterior veins dark brown and well developed; costa reaching 0.97 of wing length (CR 0.95-0.98, s = 0.011, n = 7), only slightly extended beyond apex of radial cell (Fig. 1m); costal extension averaging 0.065 mm (0.057-0.083, s = 0.008, n = 8). Halter knob brown black, stem pale brownish gray. Legs long and slender, dark brown; fore tarsomeres 1-3 yellowish to light orange-brown; extreme base of fore femur, anterior half of coxa, and trochanter lightened to grayish orange brown; other coxae and trochanters also slightly lighter brown. *Leg armature:* ventral spines lacking on femora, only apical spines present on tibiae, and apical spines or pseudospurs on certain tarsomeres; fore tibia with sinuate, acutely tipped spine (0.083 mm, s = 0.044, n = 7) and dense comb (Fig. 1h); mid tibia apically with 2 subsequal stout spines (0.054-0.060 mm), mid tarsomeres 1 and 2 apically with paired stout spines (0.040-0.050 mm and 0.030-0.035 mm, respectively) (Fig. 1d, e); pseudospurs usually present on hind tarsomere 3 (Fig. 1a), absent on other legs. Apical 0.1 of hind tibia ventrolaterally bearing prominent subcircular patch of densely packed bristly setae (Fig. 1g), and small "brushlet" free to move at its base and easily obscured by the patch of bristles (Fig. 1g, i). Tarsi slender, greatly elongated on hind leg, hind basitarsus 1.36 x as long as hind tibia (Fig. 1g). Leg proportions and ratios:

Leg	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	TR
Fore	49*	49	21	9	5	3	8	0.43 (0.018)**	2.24 (0.148)
								0.40-0.45	2.00-2.33
Mid	73	61	43	11	4	3	7	0.69 (0.014)	3.83 (0.223)
								0.67-0.71	3.50-4.09
Hind	106	85	115	54	16	5	8	1.36 (0.005)	2.14 (0.115)
								1.35-1.36	1.96-2.27

* to convert proportions to mm, multiply values by 0.02.
**mean (standard deviation) minimum-maximum.

Tarsomeres and claws (Fig. 1a-c): Fourth tarsomeres cordiform on fore and mid legs only; short cylindrical on hind leg. Number of batonnets of 5th tarsomere: of fore leg, 7 (n = 2); 8 (n = 4) or 9 (n = 6); of mid leg, 2 (n = 8), 3 (n = 1) or 4 (n = 1); of hind leg, 6 (n = 2), 7 (n = 5) or 8 (n = 8). Claws relatively short, curved, distally pointed, stout at base; each claw basally with short rounded to acute external tooth.

Abdomen (Fig. 2): Dark grayish to reddish brown dorsally, grayish brown to reddish gray ventrally; sternum and pleuron membranous except mesal rectangular sclerite on segment VII. Apex tapering, especially if abdomen egg laden; gonopore flanked by prominent tufts of long hairs on darkened gonopophysis lobes (Gp) of sternum VIII; coxosternapodeme (Csa) tapered mesally, distally with small triangular processes directed caudad. Spermathecae dark brown; 3 present, 1 small and rudimentary, 2 large, slightly unequal, ovoid, with distinct parallel-sided necks; minute hyaline punctations visible at 250x (15-25 per hemisphere); measurements 0.132 (s = 0.008) by 0.098 (s = 0.007) mm, and 0.106 (s = 0.008) by 0.082 (s = 0.005) mm.

Eggs (Fig. 1k-l) (based on eggs extruded from abdomen): Straight to very slightly curved or S-shaped, yellowish to grayish white; surface texture rippled in profile, chorion with numerous smooth-edged, round depressions of various sizes dispersed in irregular rows over entire surface, except hemisphere of 1 end (Fig. 1-l); length 0.382 mm (0.358-0.408, s = 0.017, n = 10); ca. 400-450 eggs present per female, arranged in overlapping rows, apparently to be deposited in ribbons. Two females apparently had attempted to oviposit once captured.

MATERIAL EXAMINED. Seven females.

TYPES. Holotype female (slide mounted), Virginia, 77° 42′ W, 38° 02′ N, Louisa Co.-Spotsylvania Co. line, North Anna River, Virginia Rt. 601 at Smiths Mill Bridge, 400 m downstream from Lake Anna reservoir dam, 28 July 1977, C. R. Parker, by UV light trap (Type no. 76100, USNM). Two female paratypes (1 slide mounted, 1 in alcohol), same data as holotype. Three female paratypes (slide mounted), Virginia, 77° 33′ W, 37° 56′ N, Hanover Co.-Caroline Co. line, North Anna River, Virginia Rt. 601 at Butler's Bridge, ca. 16 km downstream from Lake Anna dam, 1 July 1976, J. R. Voshell, Jr., by UV light trap. Three paratypes deposited in U.S. National Museum, 1 each at the Virginia Polytechnic Institute and State University Entomology Collection, Blacksburg, and Florida State Collection of Arthropods, Gainesville.

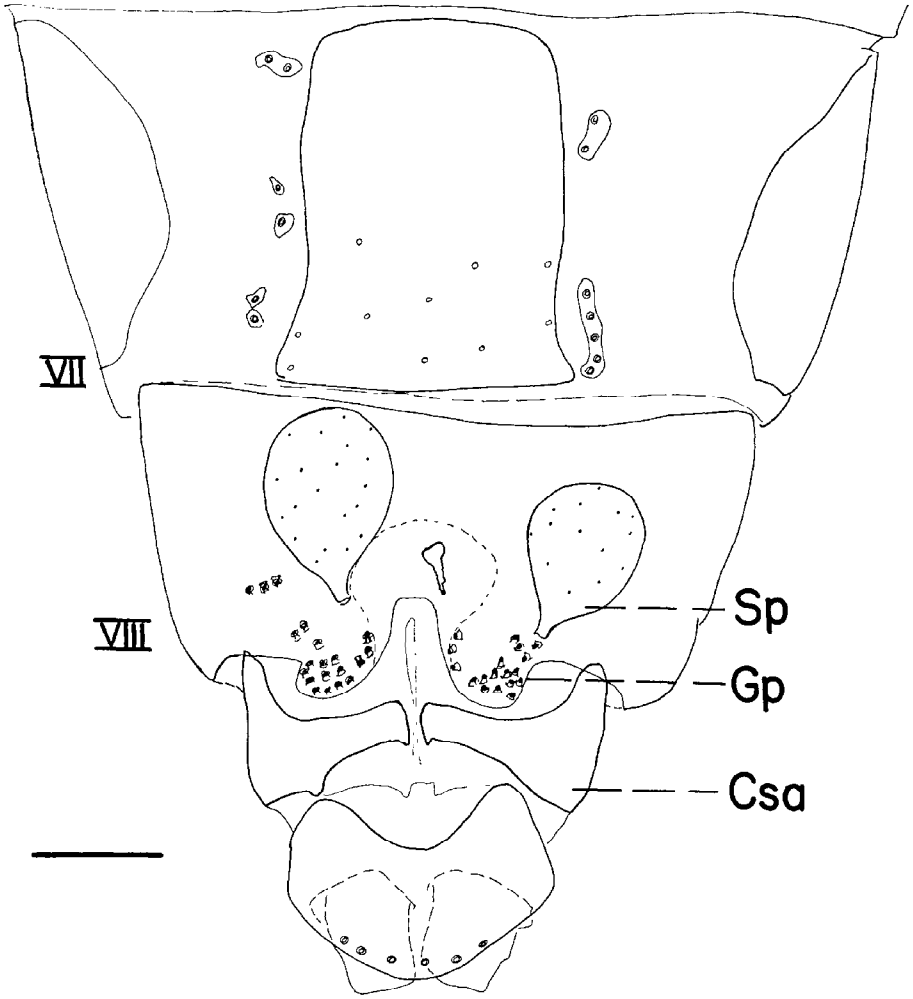

Fig. 2. *Macropeza pamunkeiana* Knausenberger and Wirth, ♀ terminalia, ventral view, to show general structure. *Csa*, coxosternapodeme IX (genital sclerotization); *Gp*, gonapophysis, bearing ventral hair tufts; *Sp*, spermatheca (dots represent hyaline punctations visible at 250 x). Horizontal bar at left indicates 0.1 mm.

ETYMOLOGY. The species name *pamunkeiana* (pa-mun-kei-ana) is a modern Latin adjective derived from the Indian place name Pamunkey ("where we took a sweat") and the Latin suffix -iana (of, belonging to). This species, collected along the North Anna River—a major tributary of the Pamunkey River—is named in remembrance of the native inhabitants of this section of the outer Piedmont and inner Coastal Plain of Virginia.

DISCUSSION. *Macropeza pamunkeiana* has developed to an extreme the "long-legged" character which helps distinguish the genus (*macro-*, large; *-peza*, foot). The LR of 1.36 appears to be a very stable character, having a standard deviation of only 0.005. The particularly elongated hind basitarsus creates a characteristic condition analagous to, but the reverse of, that found in many Chironominae (Chironomidae), in which the fore basitarsus is

greatly elongated. In fact, the 2 character states are simply strong expressions of a feature generally overlooked in distinguishing members of the 2 families: in Ceratopogonidae, the hind leg is longest, the fore leg shortest, while the Chironomidae exhibit the reverse character state.

The different manifestations of the leg armature may well be species specific, because the armature probably plays a role in prey-capture and/or mating. The leg armature is compared in Table 1; all characters except the batonnets are at the apical end of the respective segment.

BIOLOGICAL NOTES. *Macropeza pamunkeiana* was collected by black-light trap from 2 sites along the North Anna River in the York River Basin. All specimens were collected in July.

The specimens taken on 28-VII-1977 were among a remarkably large sample (ca. 5 liters) of aquatic insects trapped during a short period after sundown. Eleven other species of ceratopogonids were encountered in that sample: *Mallochohelea atripes* Wirth (150+ ♀♀), *Bezzia flavitarsis* (Malloch (18 ♀♀), *Probezzia smithii* (Coquillett) (12 ♀♀), *Dasyhelea major* (Malloch) (5 ♀♀), *B. setulosa* (Loew) (3 ♀♀), *B. glabra* (Coq.) (2 ♀♀), *Atrichopogon* sp. (2 ♀♀), *B. opaca* (Loew) (1 ♀), *D. mutabilis* (Coq.) (1 ♀), *Forcipomyia* sp. (1 ♀), *Monohelea stonei* Wirth (1 ♀). The bulk of the collection consisted of numerous Ephemeroptera (in which the large species *Hexagenia munda* Eaton and the small species *Tricorythodes* nr. *allectus* Needham predominated), Trichoptera (mostly Hydropsychidae and Hydroptilidae) and Chironomidae (predominately Tanypodinae—at least 10 spp.—and, to a lesser extent, Orthocladiinae; relatively few Chironominae were present, one of which was the well-marked *Stenochironomus poecilopterous* (Mitchell)). Chaoboridae were moderately abundant in the samples.

Some of the above insects may be presumed to be the prey species of *M. pamunkeiana,* which possesses mandibles of a form typical of the insectivorous ceratopogonine biting midges. Kieffer (1925) reported a related Palaearctic species, *M. albitarsis* (Meigen), as feeding on small insects. The general habitus of *M. pamunkeiana,* with its very long hind basitarsus, and hind tibia bearing a strong apical brush, suggests that the female has a unique way of grappling and handling her prey. The range of form in the legs of prey-capturing species is very great (Downes 1978). Downes suggested that species with elongated hind legs may be specialized to land on relatively large prey.

The larval habitat of *M. pamunkeiana* is not known, but it may be inferred from the adult collection sites that this is a rhithral species, preferring small rivers and streams. *Macropeza albitarsis* occurs in small rivers in Europe (Havelka 1978). The North Anna River is a fourth-order stream in a narrow eastward-sloping valley at the points of collection, with a 35-year average discharge of 10.8 m^3/sec (Simmons and Voshell 1978).

Lake Anna, a recent 32,000 ha reservoir formed by a dam 400 m upstream from the Louisa Co. collection site, was filled in 1972 (Simmons and Voshell 1978). No *M. pamunkeiana* were encountered in any of the 10 reservoir-sited light trap samples examined from 1973-1976. By contrast, other Sphaeromiini, such as *Sphaeromias longipennis* (Loew), were regularly trapped along the reservoir. *Sphaeromias longipennis* larvae were consistently collected from 2 and 4 m depths by J. R. Voshell from 1972 to 1974. From our personal experience, many of the species of Sphaeromiini are inhabitants of

TABLE 1. LEG ARMATURE OF *Macropeza* SPECIES.

Leg:	ti	ta_1	ta_2	ta_3	ta_4	ta_5
Fore:	comb and spine: *pamunkeiana* *blantoni*	—	—	—	—	batonnets: *pamunkeiana:* 8-9 *blantoni:* 7
Mid:	2 spines: *pamunkeiana* *blantoni*	2 spines: *pamunkeiana* *blantoni*	2 spines: *pamunkeiana* *blantoni*	—	—	batonnets: *pamunkeiana:* 2 *blantoni:* 3
Hind:	brush: *pamunkeiana* *blantoni*	2 spines: *blantoni*	2 pseudospurs: *blantoni*	2 pseudospurs: *blantoni* *pamunkeiana*	—	batonnets: *pamunkeiana:* 7-8 *blantoni:* 7

*ti = tibia; ta_1 = basitarsus; ta_2, ta_3, ta_4, and ta_5 are tarsomeres 2-5, respectively.

open standing water or large rivers; fewer occur in smaller watercourses. DISTRIBUTION: Virginia. This species probably has austral affinities. The only other *Macropeza* known in the Western Hemisphere, *M. blantoni,* was collected in the Florida panhandle in the Coastal Plain Physiographic Province. The section of the outer Piedmont Physiographic Province, in which *M. pamunkeiana* was collected, 16 to 32 km upstream from the Fall Line and the Coastal Plain, can be assigned to the Floridian Biotic Region of Hoffman (1969). This region is based on climatic dominance and general concordance of plant and animal distributions. The Floridian Region is somewhat more inclusive than the Austroriparian Life Zone of C. H. Merriam (in Hoffman 1969), and generally coincides with the Coastal Plain Physiographic Province, but the Floridian Region has major extensions westward along the larger river basins, such as the York.

Macropeza blantoni Wirth and Ratanaworabhan

(Fig. 1 f, n)

Macropeza blantoni Wirth and Ratanaworabhan, 1972: 216 (♀; Florida).
NOTES: To the existing description may be added:
Head: ES 4.3; antenna 1.72 mm; maxillary palpus with 9-10 sensilla; mandible with 10 strong, 2 slender teeth, and 8-11 small, sharp, ventrally-directed notches on outer margin of blade.
Thorax: Mesonotal erect setae 0.060-0.078 mm long. Wing with costal extension 0.110-0.112 mm (Fig. 1 n). *Leg armature:* ventral spines absent on femora; tibiae with only apical spines; fore tibia with dense comb and elongate, slightly curved spine (0.066-0.069 mm); 2 apical spines usually present on mid tibia, mid tarsomeres 1 and 2, and hind basitarsus; 2 pseudospurs present apically on hind tarsomeres 2 and 3. Hind tibia with apical 0.05 bearing ventro-laterally a semicircular patch of closely appressed bristly setae; "brushlet" not evident in specimen seen. Leg proportions and ratios:

Leg	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	TR
Fore	43	43	18	6	3	2	8	0.42	3.00
Mid	65	60	35	9	4	3	7	0.58	3.89
Hind	82	69	67	27	10	4	9	0.97	2.43

Batonnets: fore, 7 (n = 2); mid, 3 (n = 1); hind, 7 (n = 2).
Abdomen: Seventh sternum with mesal rectangular sclerite. *Csa* (genital sclerotization) as in *M. pamunkeiana* n. sp. Eggs sculptured as in *M. pamunkeiana;* length 0.433 (0.417-0.456, s = 0.019) mm.
MATERIAL EXAMINED: One paratopotype, 26-V-1973, W. W. Wirth.

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trap samples from which the specimens of the new species were obtained, and for information concerning the collection sites. Boris Kondratieff kindly identified the Ephemeroptera mentioned herein. William L. Grogan, Jr. of Salisbury State College, Maryland, offered helpful criticism of the manuscript.

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PARASITES ATTACKING FALL ARMYWORM LARVAE, *SPODOPTERA FRUGIPERDA*[1], IN LATE PLANTED FIELD CORN[2]

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ABSTRACT

Parasites emerged from larvae of the fall armyworm, *Spodoptera frugiperda* (J. E. Smith), collected from (1) under the husks of corn ears, (2) exposed surface areas of corn plants, and (3) broadleaf signalgrass, *Brachiaria platyphylla* (Griseb.) Nash. Mortality was highest among larvae

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