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RYSZARD SZADZIEWSKI

# Biting midges of the genus Eohelea Petrunkevitch (Insecta, Diptera, Ceratopogonidae) from Baltic amber (in the collection of the Museum of the Earth)

ABSTRACT: Four species of the genus *Eohelea* (Stilobezziini) (females with stridulating organ on the wings) are described and illustrated. They are: *E. stridulans* Petrunkevitch (female, male), *E.* sp. *A.* indet. (male), *E.* sp. *B* indet. (female), and *E. petrunkevitchi* sp. n. (female). A new, honey-comb like, type of stridulating organ, as well as males are described for the first time in the genus. A complete generic diagnosis is also provided. The genus *Eohelea* seems to be closely related to the recent monotypic genus *Parastilobezzia* from Colombia.

## INTRODUCTION

From the Baltic Eocene amber 23 species of Ceratopogonidae have been described: three by H. Loew (1850), one by C. G. Giebel (1856), 18 by F. Meunier (1904), and one by A. Petrunkevitch (1957).

The genus *Eohelea* is a group of poorly known fossil biting midges known only from the Baltic amber. A. Petrunkevitch (1957) proposed the genus with its own subfamily Eoheleinae basing on single uncomplete female *Eohelea stridulans* from the Zoological Museum in Copenhagen. Transverse ridges found on the female wing membrane were recognized by the author as a stridulating apparatus. This character is unusual because in the order Diptera none of the species, living or fossil, have ever been known to possess organs of stridulation. W. W. Wirth *et al.* (1974) placed the genus in the tribe Ceratopogonini of the subfamily Ceratopogoninae. S. G. Larsson (1978) mentioned that in the Zoological Museum in Copenhagen a further nine females with the same organ as in *E. stridulans* have been found.

In the present paper I describe four species of the genus and provide for the first time description of males, and a new type of stridulating organ, the honey-comb like one. Genus *Eohelea* should be placed in the tribe Stilobezziini *sensu* W. W. Wirth, W. L. Grogan (1981) of the subfamily Ceratopogoninae.

## MATERIAL AND METHODS

All specimens examined are from the amber collection of the Museum of the Earth, Polish Academy of Sciences in Warsaw. Each piece of the amber is labelled by an inventory number. They were found on the Baltic coast at Gdańsk.

For general morphology of Ceratopogonidae see W. W. Wirth *et al.* (1977). Some special terms are used in the descriptions. Wing length is measured from the basal arculus to the tip. Female antennal ratio is the value obtained by dividing the combined lengths of the distal five flagellomeres to the preceding eigth. Male antennal ratio is the ratio of last four segments to the preceding eigth. Tarsal ratio is obtained by dividing length of basitarsus by length of second tarsomere.

## DESCRIPTIONS

### Genus **Eohelea** Petrunkevitch, 1957

*Eohelea* Petrunkevitch, 1957: 208, type-species *Eohelea stridulans* Petrunkevitch, by original designation.

**Diagnosis.** A genus of very small extinct biting midges that can be distinguished from all other Ceratopogonidae genera by the following combination of characters: female wing broad with stridulating organ in the cell $R_5$; male flagellum with 12 segments, not plumose; male wing narrower without stridulating organ; small cell $R_1$ and long cell $R_2$ extending nearly to wing tip present, costa prolonged to wing tip; palpus short, third palpal segment with sensory pit; female claws with inner basal tooth.

**Description.** Body very small, stout. Female antenna with 13 cylindrical flagellomeres, distal five flagellomeres elongate; male antenna with 12 cylindrical flagellomeres, last segment longest, plume not developed; in both sexes proximal eigth flagellomeres bearing basal ring of long verticils and subapical pair of hyaline sensory setae (sensilla basiconica) on some segments visible; last five flagellomeres in female and last four segments in male with basal verticils and with scattered shorter setae and sensilla basiconica on distal portion; female antennal ratio about 0.9. Palpus short, five segmented; third palpal segment ovoid with distinct sensory pit bearing long, slender capitate sensilla. Eyes separate, bare.

Scutum without anterior spine or tubercle, surface with long setae and short pubescence, humeral pits absent. Pronotum hidden below humeri. Wing broad in female, narrower and shorter in male, surface with small microtrichia, macrotrichia absent; short cell $R_1$ and long cell $R_2$ extending nearly to wing tip present; costa prolonged to wing tip; *r—m* crossvein slightly oblique, tip placed past base of $R_1$; media petiolate, base of vein $M_2$ invisible; in female distal portion of vein $M_1$ obsolete, in male well visible; vein $M_3$ distinct; female wing with stridulating organ in anterodistal portion of cell $R_5$; stridulating field ovoid, composed of transverse ridges or honey-comb like cells. Legs slender and unarmed, long setae present; fourth tarsomeres cylindrical or subcylindrical, fifth tarsomeres laterally compressed, slender; female claws short, equal, with inner basal tooth; male claws short, simple; empodium absent.

Female abdomen usual, cerci short. Male genitalia with sternite IX with shallow caudomedian excavation; gonocoxite short, simple; gonostyle rather long and slender, with pointed tip; aedeagus longer that gonocoxite, distal portion slender, rounded tip ventrally curved, basal arms well developed; parameres rodlike, separated; tergite IX rather long.

### **Eohelea stridulans** Petrunkevitch, 1957 (Figs 1—15)

*Eohelea stridulans* Petrunkevitch, 1957: 208 (female),

**Diagnosis.** Female with stridulating organ composed of 17—18 transverse ridges; male very small, wing length 0.5 mm.

**Description.** Female. Body brown, total length 1.3, 1.3, 1.1 mm. Habitus as on Fig. 1.

Head brown. Flagellum with 13 segments; total length 485, 426 and 452 $\mu$m; last flagellomere shorter than preceding one (Figs 2, 3); antennal ratio 0.91, 0.95; basal ring of long verticils well visible on all flagellomeres, on distal five segments one or two pairs of sensilla basiconica well visible, last flagellomere with shorter subapical and apical setae. Palpus rather five segmented, short (Fig. 4), third palpal segment enlarged, ovoid, with round sensory pit bearing long and slender capitate sensilla; lengths of three last palpal segments as follows (in $\mu$m): 24—20—28. Eyes separated (Fig. 5), bare.

Thorax brown. Scutellum with two lateral and two submedian setae; haltere brown. Wing length 718, 822, 717 $\mu$m; breadth 390, 390 $\mu$m; wing length measured from the base 821, 948, 806 $\mu$m; wing membrane covered with small microtrichia, weakly hyaline; veins rather brown; cell $R_1$ short, about 2—3 times longer than breadth; cell $R_2$ long and slender extending nearly to wing tip, costa prolonged to wing tip; vein $R_1$ ending at about 0.5 of wing length, vein $R_{4+5}$ ending at about 0.95 of wing length (Figs 6—8); distal portion of vein $M_1$ lacking; in anterodistal portion of cell $R_5$, just below the vein $R_{4+5}$ elliptic stridulating field composed of 17—18 ridges (Figs 6, 7); length of the field 201, 216 $\mu$m, breadth 75, 82 $\mu$m; stridulating apparatus formed by simple convex ridges on wing membrane (Fig. 9). Legs brown, slender (Fig. 10); tibial comb with four spines, hind basitarsus with a row of stronger setae; fourth tarsomeres cylindrical or subcylindrical; claws short, equal, with inner basal tooth (Fig. 11); empodium absent; tarsal ratio of fore leg — 2,0, 2.2, 2.2, middle leg — 2.6, 2.7, 2.8, hind leg — 2.9, 2.8, 2.9.

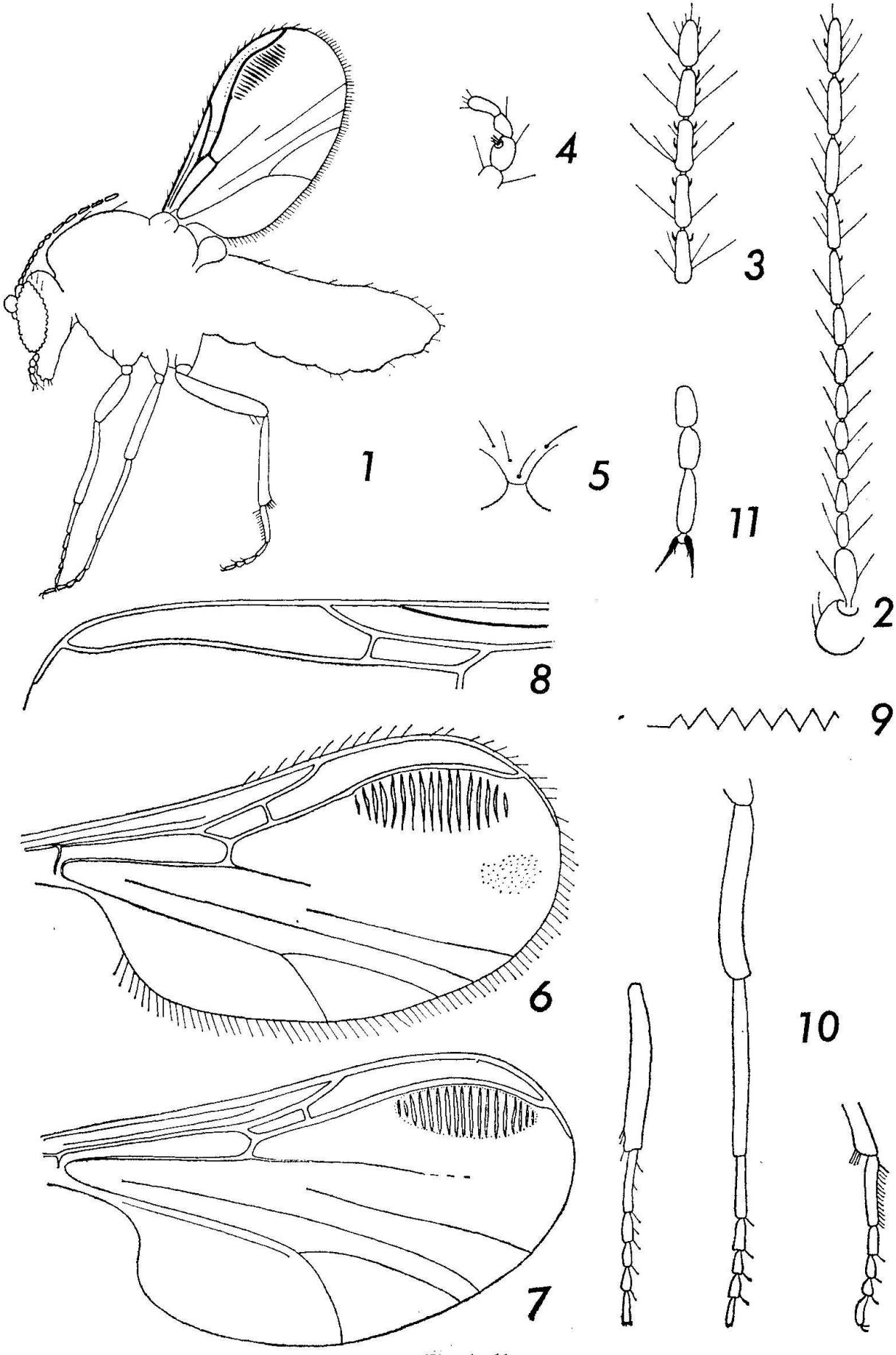
Length of legs as follows (in $\mu$m):

| | femur | tibia | tarsus |
|---|---|---|---|
| fore leg | 280, 288, 265 | 216, 248, 234 | 250, 256, 265 |
| middle leg | 263, 312, 312 | 240, 312, 296 | 265, 281, 265 |
| hind leg | 320, 360, 374 | 320, 312, 328 | —, —, 296 |

Male. Body brown, total length about 0.9 mm.

Head brown. Flagellum with 12 segments (Fig. 12), total length 396 $\mu$m, last flagellomere (48 $\mu$m) longer than preceding one; plume not developed, antennal ratio 0.65; basal ring of long verticils present on all flagellomeres, three last flagellomeres with long preapical setae, last segment with other scattered setae; four distal flagellomeres with preapical pair of sensilla basiconica. Palpus short, apparently five segmented, last segment about 20 $\mu$m long; sensory pit on third palpal segment not visible (Fig. 13). Eyes separated, bare.

Thorax brown. Scutellum with two lateral and two submedian setae, haltere brown. Wing length 512 $\mu$m, length measured from the base 567 $\mu$m; veins brown; cells $R_1$ and $R_2$ present, cell $R_2$ long and slender (Fig. 14) extending nearly to wing tip,



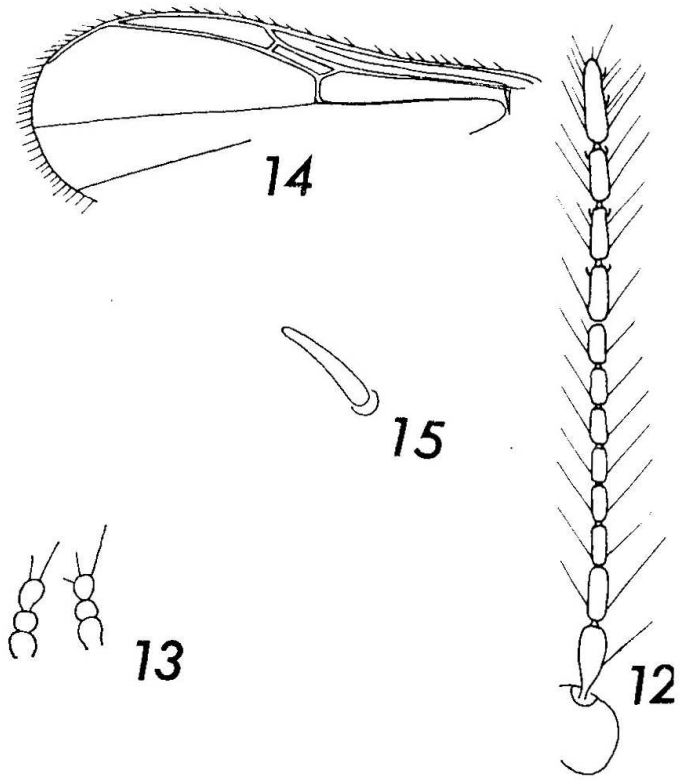

Figs 1—11

*Eohelea stridulans* Petrunkevitch, female

1 — general view, 2 — flagellum (No. 1884/1a), 3 — distal five flagellomeres (No. 6940b), 4 — palpus (No. 6940b), 5 — eye separation (No. 1884/1a), 6 — wing (No. 1884/1a), 7 — wing (No. 7961), 8 — radial veins (No. 6940b), 9 — transverse section of stridulating ridges, 10 — fore, middle and hind leg (No. 1884/1a), 11 — last tarsomeres of fore leg (No. 6940b)

costa long extending past end of vein $R_{4+5}$ and ending nearly at wing tip halfway between ends of $R_{4+5}$ and $M_1$; vein $R_1$ ending at 0.5 and $R_{4+5}$ at 0.86 of wing length; vein $M_1$ straight, $M_2$ invisible at base; stridulating organ absent. Legs brown, slender; tibial comb present; fourth tarsomeres cylindrical or subcylindrical; claws short, equal, simple; empodium absent; tarsal ratio of fore leg 2.0, hind leg 2.5; length of tarsi as follows (in $\mu$m): fore leg 218, middle leg 234, hind leg 250.

Genitalia badly visible; gonostyle rather long and slender (Fig. 15).




Figs 12—15
*Eohelea stridulans* Petrunkevitch, male
*12* — flagellum, *13* — palpi, *14* — wing, *15* — gonostyle

**Material examined.** No. 1884/1a, female, male; No. 6940 b, female; No. 7961 from Gdańsk-Stogi, female.

**Remarks.** A. Petrunkevitch (1957) in his description of the species stated that stridulating organ is composed of 15 parallel ridges. In now examined females it ranges from 17 to 18 ridges. It seems that number of the ridges is not stable. Male now described as *E. stridulans* was found together with female in the same piece of the amber, so they most probably belong to the same species.

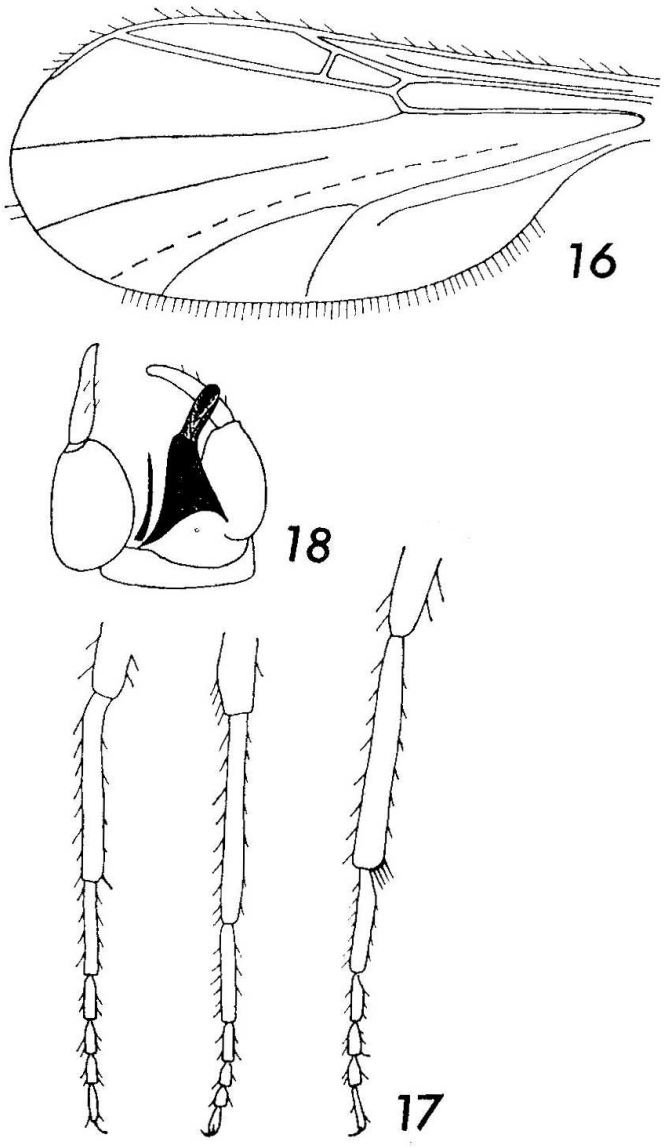
## **Eohelea** sp. **A** indet.
(Figs 16—18)

**Diagnosis.** Male of the species is very similar to male of *E. stridulans* but is distinctly larger.

**Description.** M a l e. (Female unknown). Body brown, total length 1.1 mm.

Head brown. Flagellum with 12 segments, not plumose, total length about 432 $\mu$m, last flagellomere longer than preceding one; antennal ratio 0.59. Palpus not visible. Eyes hardly visible.

Thorax brown. Scutellum with two lateral and two submedian setae, haltere brown. Wing length 805 $\mu$m, breadth 328 $\mu$m; wing length measured from the base 885 $\mu$m; veins brown; two radial cells present, cell $R_2$ long (Fig. 16), costa long extending past end of vein $R_{4+5}$ and ending nearly at wing tip halfway between ends of $R_{4+5}$ and $M_1$; vein $R_1$ ending at 0.5 of wing length; vein $M_1$ straight, $M_2$ not visible at base; stridulating organ absent. Legs brown, slender (Fig. 17); tibial comb with four spines, fourth tarsomeres cylindrical; claws short, equal and simple; empodium absent; tarsal ratio of fore leg 2.3, middle leg 2.4, hind leg 2.2;




Figs 16—18
*Eohelea* sp. *A* indet., male
*16* — wing, *17* — tibiae and tarsi of fore, middle and hind leg, *18* — genitalia

Length of legs as follows (in $\mu$m):

| | femur | tibia | tarsus |
|---|---|---|---|
| fore leg | 296 | 265 | 296 |
| middle leg | 304 | 343 | 343 |
| hind leg | 328 | 390 | 344 |

Genitalia (Fig. 18); gonocoxite simple, short; gonostyle rather long and slender with pointed tip; sternite IX with shallow excavation; parameres rodlike, separated, aedeagus longer than gonocoxite, distal portion slender with rounded tip ventrally curved; basal arms well developed; tergite IX hardly visible, rather long.

**Material examined.** No. 393 c, male.

### **Eohelea** sp. **B** indet.
(Figs 19, 20)

**Diagnosis.** Female of this species differs from females of *E. stridulans* in having stridulating organ composed of 21 ridges and dark blackish brown body.

**Description.** Female. Body dark blackish brown, total length 1.1 mm.

Head rather black. Flagellum with 13 segments, total length about 424 $\mu$m; distal five flagellomeres (Fig. 19) cylindrical, last flagellomere shorter than preceding one, one or two pairs of sensilla basiconica well visible; antennal ratio 0.93. Palpus hardly visible, two last segments as in *E. stridulans*. Eyes separated, bare.

Thorax blackish brown. Mesonotum grayish pollinose, scutellum and halteres not visible. Wing length 874 $\mu$m; breadth 375 $\mu$m, wing length measured from the base 920 $\mu$m; veins dark brown, cell $R_1$ short, cell $R_2$ long and slender extending nearly to wing tip, costa prolonged to wing tip; vein $R_1$ ending at about 0.5—0.6 of wing length, vein $R_{4+5}$ ending at about 0.93—0.94 of wing length; in anterodistal portion of cell $R_5$, just below vein $R_{4+5}$ elliptic stridulating field composed of 21 ridges (Fig. 20), length of the field 201 $\mu$m, breadth about 90 $\mu$m. Legs dark blackish brown, slender, hardly visible.

Male unknown.

**Material examined.** Female, in the piece of Baltic amber No. 14030 from Gdańsk-Stogi (coll. T. Giecewicz).

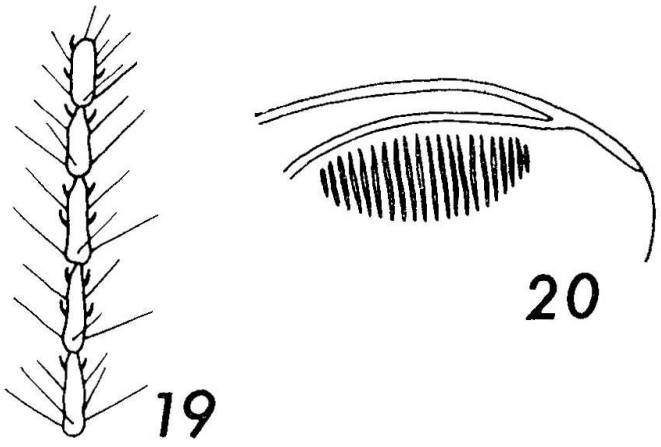
### **Eohelea petrunkevitchi** sp. n.
(Figs 21—25)

**Diagnosis.** The new species is characteristic in having stridulating organ honey-comb like.

**Description.** Female. Body dark blackish brown, total length 1.5 mm.

Head blackish brown, height 340 $\mu$m. Flagellum with 13 segments, total length 589 $\mu$m; last flagellomere shorter than preceding one (Fig. 21), antennal ratio 0.88; flagellomeres cylindrical, basal ring of long verticils well visible on all flagellomeres; fifth flagellomere and distal five segments with well visible sensilla basiconica. Palpus five segmented (Fig. 22), short, last palpal segment longest; four distal palpal segments with long setae, sensory pit on third palpal segment not visible. Eyes separated, bare; one frontal and five long orbital setae present.

Thorax dark blackish brown, lateral sclerites shining, mesonotum with strong setae and pubescence. Scutellum with eight strong setae, haltere dark brown. Wing length 916 $\mu$m, breadth 474 $\mu$m, wing length measured from the base 1001 $\mu$m; veins dark, cell $R_1$ slender and short, cell $R_2$ slender and long extending nearly to wing tip, costa prolonged to wing tip; vein $R_1$ ending at about 0.6 of wing length, vein $R_{4+5}$ ending at about 0.9 of wing length; just below vein $R_{4+5}$ ovoid stridulatory field (Fig. 23) honey-comb like with round cells about 16 $\mu$m in diameter, their bottom convex on dorsal surface of the wing (Fig. 24); length of the field 263 $\mu$m, breadth 143 $\mu$m; vein $M_1$ strongly curved, distally lacking; vein $M_3$ well visible. Legs blackish brown, slender (Fig. 25), tibial comb with four spines, fourth tarsomeres subcylindrical, claws short with inner basal tooth, empodium absent; tarsal ratio of middle leg 2.3, hind leg 2.9; length of some leg segments as follows (in $\mu$m): fore leg — femur 316, tibia 337; middle leg — tibia 395, tarsus 338; hind leg — femur 395, tibia 426.




Figs 19, 20
*Eohelea* sp. *B* indet., female
*19* — distal five flagellomeres, *20* — stridulating organ

**Material examined.** Holotype — female, in the piece of Baltic amber No. 13990 from the Holocene deposits in Gdańsk-Stogi (coll. T. Giecewicz), housed in the Museum of the Earth, Polish Academy of Sciences, Warsaw.

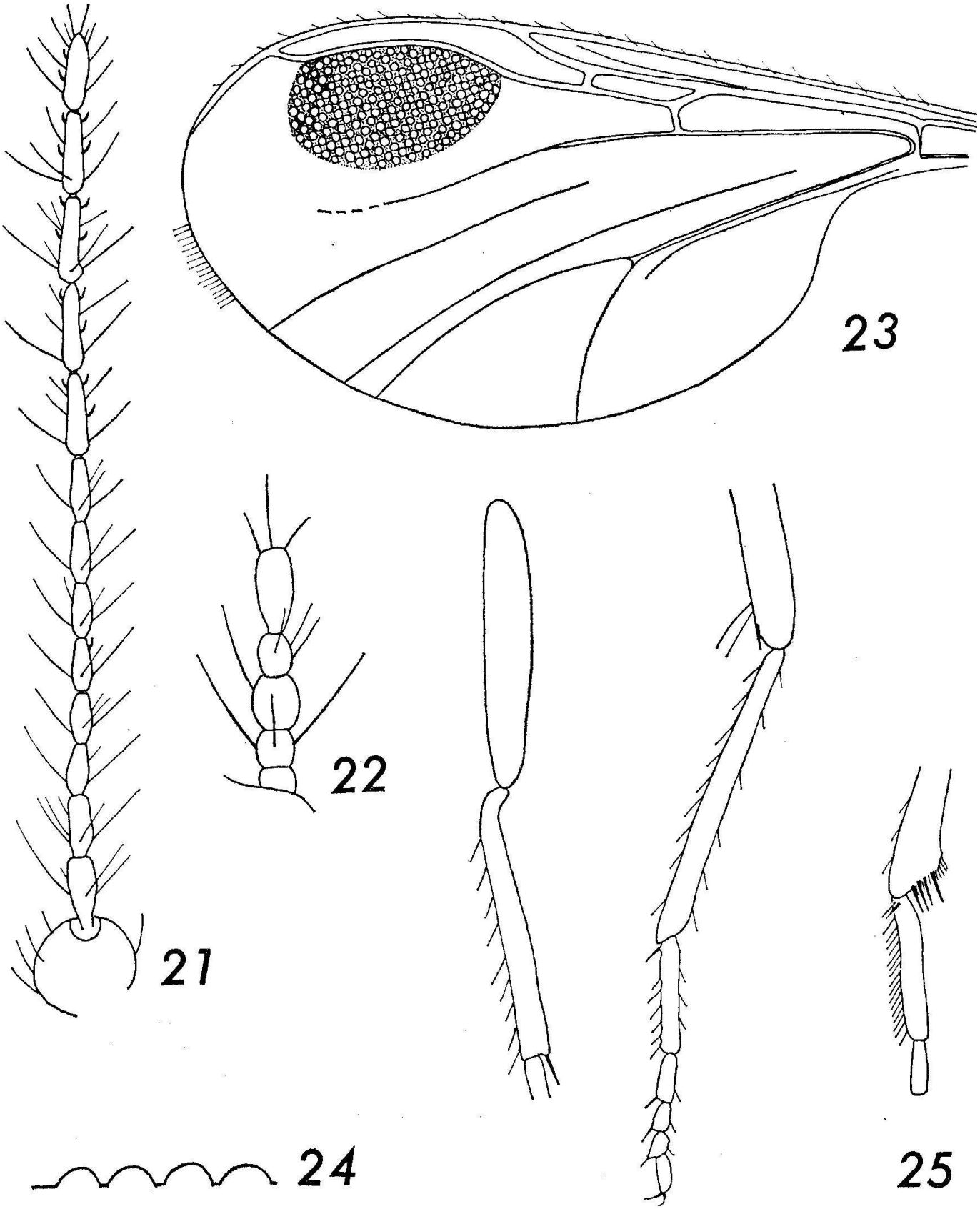
**Derivation of the name.** This species in named in honour of the late Professor A. Petrunkevitch in recognition of his discoverring the stridulatory organ in the fossil Ceratopogonidae.

## DISCUSSION

Plesiomorphic characters of *Eohelea* belonging to the basic design of Ceratopogonidae are as follows:

1. Costa long extending past end of vein $R_{4+5}$ and ending near tip of wing.
2. Crossvein (or vein $R_{2+3}$) connecting $R_1$ and $R_{4+5}$ present.
3. Vein $M_3$ well developed.
4. Vein $R_{4+5}$ very long.
5. Male genitalia with parameres separated.
6. Legs slender.
7. Female antenna with 13 flagellomeres.

Apomorphic characters of *Eohelea* in relation




Figs 21—25

*Eohelea petrunkevitchi* sp. n., female

*21* — flagellum, *22* — palpus, *23* — wing, *24* — transverse section of stridulatory field, *25* — some segments of fore, middle and hind leg

to the basic design of Ceratopogonidae are as follows:

1. Female wing with stridulating organ.
2. Female wing broad.
3. Female wing with large cell $R_5$.
4. Distal portion of vein $M_1$ in female wing reduced.
5. Male flagellum with reduced plume.
6. In male number of flagellomeres reduced from 13 to 12.
7. Palpus very short.

Some apomorphic characters in the genus are correlated with the stridulating organ development i.e. female wing broad with large cell $R_5$ where the stridulatory field is placed and vein $M_1$ is reduced distally. Apparently, in male, disappearance of flagellar plume and a fewer number of flagellomeres is connected with the same character as it is in female, although in the recent genus *Echinohelea* Macfie, 1940 plume is also reduced on male flagellum and females have no stridulating organ.

It seems that the monotypic genus *Parastilobezzia* Wirth et Blanton, 1970 from Colombia is the closest recent relative of the genus *Eohelea*. Some important characters are common for both these genera i.e. the wing with a long and slender second radial cell, costa extending nearly to wing tip, small first radial cell present; palpus short (in *Parastilobezzia* apparently four segmented); male genitalia with separated parameres what is usual situation for the most genera in the tribe Stilobezziini. Obviously *Parastilobezzia* female does not have a stridulating organ. In addition, its claws are single with minute barb and male flagellum has well developed plume and 13 segments what is usual for Ceratopogonidae as a whole.

*Parabezzia* Malloch, 1915 (North America, South America, whole Africa) and *Fittkauhelea* Wirth and Blanton, 1970 (Amazon of Brazil) are also close to *Eohelea*. Females in these genera have also long vein $R_{4+5}$ and costa is prolonged to the wing tip, but they have reduced crossvein between $R_1$ and $R_{4+5}$ so the radial cell is single, third palpal segment is without sensory pit and male genitalia have parameres fused and reduced to a slender hyaline rod or absent; palpus is four segmented since two last segments are fused. Wings of males in these both genera have very short vein $R_{4+5}$.

Wing venation in the genus *Eohelea* is also similar to that of *Alluaudomyia (Paralluaudomyia) maculata* Clastrier, 1960 from Congo, which has very long single radial cell reaching almost tip of the wing, and costa is prolonged to the wing tip and to the end of vein $M_1$.

*Department of Invertebrate Zoology*
*University of Gdańsk*
*Czołgistów 46*
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RYSZARD SZADZIEWSKI

# Kuczmany rodzaju *Eohelea* Petrunkevitch (Insecta, Diptera, Ceratopogonidae) z bursztynu bałtyckiego (w kolekcji Muzeum Ziemi)


## Streszczenie

Rodzaj *Eohelea* Petrunkevitch, 1957 jest nieliczną grupą wymarłych kuczmanów znanych jedynie z bursztynu bałtyckiego (eocen). Samice ich zaopatrzone są w narządy strydulacyjne znajdujące się w dystalnej części skrzydła, w komórce $R_5$, co jest zjawiskiem nie spotykanym wśród innych owadów. Sam narząd strydulacyjny ma kształt owalnego pola pokrytego poprzecznymi żeberkami lub komorami jak w plastrze miodu. Dna tych komór, podobnie jak i żeberka, są wypukłe na stronie grzbietowej skrzydła, a wklęsłe na powierzchni dolnej. Samce nie mają narządu strydulacyjnego, natomiast liczba członów flagellum w ich czułkach jest zredukowana z 13 do 12. Na proksymalnych członach wici brak długiego owłosienia charakterystycznego dla samców kuczmanów.

W oparciu o materiały znajdujące się w kolekcji inkluzji bursztynowych Muzeum Ziemi PAN w Warszawie opisano *Eohelea stridulans* Petrunkevitch, 1957 (samica, samiec), *E.* sp. *A* indet. (samiec) *E.* sp. *B* indet. (samica) oraz *E. petrunkevitchi* sp. n. (samica). Po raz pierwszy przedstawiono pełną diagnozę rodzaju *Eohelea*, uzupełnioną o po raz pierwszy opisane dla rodzaju samce.

Autor zestawił cechy plezjomorficzne i apomorficzne badanego rodzaju. Niektóre cechy apomorficzne są skorelowane z pojawieniem się narządu strydulacyjnego. Tak więc u samicy skrzydło jest szerokie, z dużą komórką $R_5$, w której zlokalizowane jest pole strydulacyjne oraz zanikła część dystalna żyłki $M_1$. Wydaje się, że redukcja długiego owłosienia na czułkach samca oraz zmniejszenie liczby członów wici może mieć również związek z wykształceniem aparatu strydulacyjnego u samicy. Spośród współczesnych rodzajów najbliżej spokrewnionym z *Eohelea* jest monotypowy rodzaj *Parastilobezzia* znany z Kolumbii.


*Katedra Zoologii Bezkręgowców*
*Uniwersytet Gdański*
*ul. Czołgistów 46*
*81-378 Gdynia, w czerwcu 1983*