UDC 591.471.274:595.741(477-924.52)

© 2017 H. V. SEREDIUK

BASED ON FORE WING VENATION MORPHOMETRIC APPROACH TO THE DETERMINATION OF NEUROPTERA (INSECTA) OF THE UKRAINIAN CARPATHIANS

Середюк, Г. В. Морфометричний підхід до визначення сітчастокрилих комах (Insecta: Neuroptera) Українських Карпат за жилкуванням передніх крил. *Вісті Харків. ентомол. т-ва*. 2017. Т. XXV, вип. 1. С. 57–70.
Запропоновано метод визначення сітчастокрилих комах, що не вимагає препарування. Метод базується на морфометричних індексах жилкування передніх крил і апробовано на сітчастокрилих з Українських Карпат. Складено ключ для визначення дев'яти родин ряду. Окремо розглянуто родину Chrysopidae. Запропоновано ключі для визначення восьми родів у її складі та чотирьох видів роду *Nineta: N. vittata* Wesmael, 1841, *N. inpunctata* Reuter, 1894, *N. pallida* Schneider, 1846 и *N. flava* (Scopoli, 1763). Для кожного з чотирьох видів наведено статистичний аналіз мінливості діагностичних ознак і обґрунтовано можливість використання морфометричних індексів у визначенні видів. 16 рис., 2 табл., 22 назви
Ключові слова: морфометричний підхід, сітчастокрилі, ключ для визначення, Neuroptera, Chrysopidae, *Nineta*, Українські Карпати.

Середюк, А. В. Морфометрический подход к определению сетчатокрылых насекомых (Insecta: Neuroptera) Украинских Карпат, основанный на жилковании передних крыльев. *Изв. Харьк. энтомол. о-ва*. 2017. Т. XXV, вып. 1. С. 57–70.
Предложен метод определения сетчатокрылых насекомых, не требующий препарирования. Метод основан на морфометрических индексах жилкования передних крыльев и апробирован на сетчатокрылых из Украинских Карпат. Составлены определительные таблицы для девяти семейств отряда. Отдельно рассмотрено семейство Chrysopidae. Предложены определительные таблицы для восьми родов в его составе и четырёх видов рода *Nineta: N. vittata* Wesmael, 1841, *N. inpunctata* Reuter, 1894, *N. pallida* Schneider, 1846 и *N. flava* (Scopoli, 1763). Для каждого из четырёх видов приведён статистический анализ изменчивости диагностических признаков и обоснована возможность использования морфометрических индексов в определении видов. 16 рис., 2 табл., 22 назв.
Ключевые слова: морфометрический метод, сетчатокрылые, определительные таблицы, Neuroptera, Chrysopidae, *Nineta*, Украинские Карпаты.

Serediuk, H. V. Based on fore wing venation morphometric approach to the determination of Neuroptera (Insecta) of the Ukrainian Carpathians. *The Kharkov Entomol. Soc. Gaz*. 2017. Vol. XXV, iss. 1. P. 57–70.
A method of determining net-winged insects that does not require preparation is proposed. The method is based on the morphometric indices of fore wing venation and has been applied to net-winged insects from the Ukrainian Carpathians. A key to identification of nine families of the order has been compiled. The family Chrysopidae is considered separately, and keys to identification of its eight genera and four species of the genus *Nineta* (*N. vittata* Wesmael, 1841, *N. inpunctata* Reuter, 1894, *N. pallida* Schneider, 1846, and *N. flava* (Scopoli, 1763)) have been proposed. The statistical analysis of variability of diagnostic characters in each of these species is given, and the possibility of using the morphometric indices in species determination is grounded. 16 figs., 2 tabs., 22 refs.
Keywords: morphometric method, net-winged insects, key to identification, Neuroptera, Chrysopidae, *Nineta*, the Ukrainian Carpathians.

I n t r o d u c t i o n . The net-winged insects (Neuroptera = Planipennia) include free-living holometabolous taxa. The world fauna of this order embraces 5,937 described species, including 469 fossil ones (Zhang, 2013). About 310 net-winged species occur in Europe (Hölzel, 1984) and about 100 species — in Ukraine (Zakharenko, 1997).

Neuropteran species are characterized by highly diverse morphological structure of body and wing venation. The smallest species of the order belong to the family Coniopterigidae Burmeister, 1839 have the wing span about 2–3 mm length, the largest forms belong to the family Myrmeleontidae Latreille, 1803 — with a maximum wind span of 170 mm.

Wings of many neuropteran species are covered by setae arranged in one or several rows along the main veins and sometimes along the cross veins. Often wing edges are densely covered by setae forming a fringe (Fig. 1). Anterior and posterior edges of wings sometimes have the tiny inserted veins arranged between the terminal branches of longitudinal veins *(trz)*. Fore wings in some neuropterans have pterostigma — the cuticular darkened thickening in distal part of anterior wing edge. Cross veins in neuropterans may be scattered irregularly, but often they are arranged in rows, also called gradations of cross veins (Fig. 1).

Main longitudinal veins in neuropterans have two types of branching: (1) main veins are arranged one parallel to another or with slight inclination successively branching into final veins and by shape resembling a comb; (2) the vein is strongly inclined and branched into two smaller veins, which in their turn keep on branching dichotomously (Aspöck and Aspöck, 2007).

Serediuk H. V. State Museum of Natural History of National Academy of Sciences of Ukraine,
18, Theatralna St., Lviv, 79008, UKRAINE; e-mail: anna.serediuk@gmail.com

Received 10.04.2017 **Accepted 10.05.2017 by Dr. A. G. Shatrovskiy** **Published 15.05.2017**

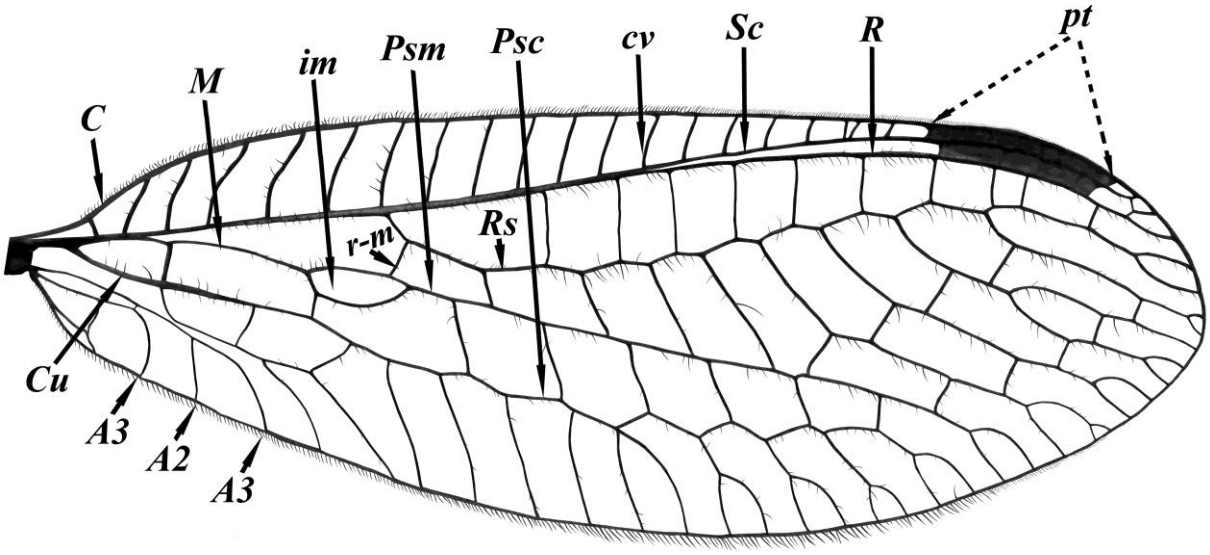


Fig. 1. General scheme of fore wing venation in Chrysopidae (*Chrysopa* Leach in Brewster, 1815): *A1–A3* — anal vein, *C* — costal vein, *Cu* — cubitus, *M* — median vein, *Psm* — pseudomedian vein, *Psc* — pseudocubitus, *R* —radius, *Sc* — subcostal vein, *im* — intramedian cell, *pt* — pterostigma, *cv* — cross veins of costal sector, *r-m* — radial-median vein, *Rs* — radial sector.

The identification of different taxa of net-winged insects is rather complicated, and many species need previous preparation. To simplify the method of determination, the author uses the morphometric approach based on the peculiarities of fore wing venation. As a result, new keys to identification of families, genera of the family Chrysopidae Schneider, 1851, and four species of the genus *Nineta* Navàs, 1912 have been compiled.

Material and methods. Fauna of Neuroptera of the Ukrainian Carpathians has been studied during the field research in 2009–2017. The studied material includes 3,500 specimens belonging to 72 species from 26 genera and 8 families. All specimens were collected in 93 localities of the Ukrainian Carpathians and include both the author's material and personal collections of Yu. Geriak, V. Chumak, M. Chumak, M. Varyvoda, and A. Zamoroka. A part of the processed material has been verified by P. Duelli (Swiss Federal Research Institute WSL, Birmensdorf, Switzerland).

The material collected by author were picked mainly by means of sweeping net, black-light traps and combi-traps in various plant formations at the different altitudes of Lviv, Ivano-Frankivsk, and Chernivtsi regions, and in the Transcarpathian Lowland.

As well, the author has worked up the entomological collections of different institutions, as follows: the Department of Entomology and Conservation of Biodiversity and Zoological Museum of the Uzhorod National University; State Museum of Natural History of the National Academy of Sciences of Ukraine (Lviv); Museum of Nature of the Vasyl Karazyn Kharkiv National University.

For taxa identification a binocular microscope MBS-10 with an eyepiece-micrometer has been used (scale bar = 0.1 mm). Photographs were taken by the camera Canon EF 100 mm f/2.8L Macro IS USM and then processed in Photoshop CS5. Angle of divergence between RA and RP was measured on the photos using protractor (scale bar = 0.1°). Names of wing's parts and structures correspond to common terminology (Fig. 1).

In the keys to determination the author used common morphological characters and for the first time elaborated and applied the special index ratio between the length of inner structures of fore wings and their width (Table 1). As an average value, the statistic measure median was used. The obtained measurements were processed by means of the software packages Microsoft Excel 2007 and Statistica 6.0.

Table 1 contains the results of measurements for one of the Carpathian species — *Chrysoperla carnea* (Stephens, 1836), known as the common green lacewing. This species is common both to the Ukrainian Carpathians and to Europe as a whole, and occurs in Asia and America. In the author's material this species is numerous and has been collected in most places. Thus, it is a practical object for testing the morphometric method.

Table 1. Main morphometric characters of fore wing structure in *Chrysoperla carnea* (Stephens, 1836) from the Ukrainian Carpathians, as a model

n	Characters																		
	W			*r1*			*r2*			*im*			*m2*			*m3*			AD, °
	length, mm	width, mm	I_W	length, mm	width, mm	I_{r1}	length, mm	width, mm	I_{r2}	length, mm	width, mm	I_{im}	length, mm	width, mm	I_{m2}	length, mm	width, mm	I_{m3}	
1	10.0	4.0	2.50	1.6	0.5	3.20	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.4	2.25	1.1	0.6	1.83	25.0
2	10.0	4.0	2.50	1.6	0.5	3.20	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.1	0.6	1.83	25.0
3	10.0	4.1	2.44	1.6	0.5	3.20	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.1	0.6	1.83	25.0
4	10.0	4.2	2.38	1.6	0.5	3.20	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.1	0.6	1.83	25.0
5	10.0	4.2	2.38	1.6	0.5	3.20	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.1	0.6	1.83	25.0
6	10.1	4.2	2.40	1.6	0.5	3.20	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.1	0.6	1.83	25.0
7	10.3	4.2	2.45	1.6	0.6	2.67	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.2	0.6	2.00	25.0
8	10.3	4.3	2.40	1.6	0.6	2.67	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.2	0.6	2.00	25.0
9	10.4	4.3	2.42	1.6	0.6	2.67	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.2	0.6	2.00	25.1
10	10.4	4.3	2.42	1.6	0.6	2.67	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.2	0.6	2.00	25.3
11	10.5	4.3	2.44	1.7	0.6	2.83	0.4	0.3	1.33	0.4	0.3	1.33	0.9	0.5	1.80	1.2	0.6	2.00	25.1
12	10.9	4.5	2.42	1.7	0.6	2.83	0.5	0.3	1.67	0.4	0.4	1.00	0.9	0.5	1.80	1.2	0.6	2.00	25.1
13	10.9	4.5	2.42	1.7	0.6	2.83	0.5	0.3	1.67	0.4	0.4	1.00	0.9	0.5	1.80	1.2	0.6	2.00	25.1
14	11.0	4.5	2.44	1.7	0.6	2.83	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.2	0.6	2.00	25.1
15	11.2	4.5	2.49	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.6	2.17	25.0
16	11.2	4.6	2.43	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
17	11.3	4.6	2.46	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
18	11.3	4.6	2.46	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
19	11.3	4.6	2.46	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
20	11.4	4.6	2.48	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
21	11.4	4.6	2.48	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
22	11.4	4.6	2.48	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
23	11.4	4.6	2.48	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
24	11.4	4.7	2.48	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
25	11.5	4.7	2.45	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
26	11.5	4.7	2.45	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
27	11.7	4.7	2.48	1.8	0.6	3.00	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
28	11.8	4.7	2.51	1.9	0.6	3.17	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
29	11.8	4.8	2.46	1.9	0.6	3.17	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
30	11.8	4.8	2.46	1.9	0.6	3.17	0.5	0.3	1.67	0.4	0.4	1.00	1.0	0.5	2.00	1.3	0.7	1.86	25.0
31	12.0	4.8	2.50	1.9	0.6	3.17	0.5	0.3	1.67	0.5	0.4	1.25	1.0	0.5	2.00	1.4	0.7	2.00	25.0
32	12.0	4.8	2.50	1.9	0.6	3.17	0.5	0.3	1.67	0.5	0.4	1.25	1.0	0.5	2.00	1.4	0.7	2.00	25.1
33	12.0	4.8	2.50	1.9	0.6	3.17	0.5	0.3	1.67	0.5	0.4	1.25	1.0	0.5	2.00	1.4	0.7	2.00	25.1
34	12.1	4.9	2.47	1.9	0.6	3.17	0.5	0.4	1.25	0.5	0.4	1.25	1.0	0.5	2.00	1.4	0.7	2.00	25.2
35	12.1	4.9	2.47	1.9	0.6	3.17	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.2
36	12.2	4.9	2.49	1.9	0.6	3.17	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
37	12.4	4.9	2.49	2.0	0.6	3.33	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
38	12.4	5.0	2.48	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.3
39	12.5	5.0	2.50	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.2
40	12.6	5.0	2.52	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
41	12.6	5.0	2.52	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
42	12.6	5.0	2.52	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
43	12.6	5.0	2.52	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.1
44	12.6	5.0	2.52	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
45	12.7	5.0	2.54	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
46	12.7	5.0	2.54	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
47	12.7	5.0	2.54	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
48	12.8	5.1	2.51	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
49	12.8	5.1	2.51	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
50	12.8	5.1	2.51	2.0	0.7	2.86	0.5	0.4	1.25	0.5	0.4	1.25	1.1	0.5	2.20	1.4	0.7	2.00	25.0
Me	11.5	4.7	**2.48**	1.8	0.6	**3.00**	0.5	0.3	**1.33**	0.4	0.4	**1.25**	1.0	0.5	**2.00**	1.3	0.7	**2.00**	**25.0**

Remarks: *W* — wings, *r1* — 1st radial cell, *r2* — 2nd radial cell, *im* — intramedian cell, *m2* — 2nd median cell, *m3* — 3rd median cell, AD — angle of divergence between RA and RP, $_W$ — index ratio between the length of wing and its width, I_{r1} — index ratio between the length of the 2nd radial cell and its width, I_{r2} — index ratio between the length of the 2nd radial cell and its width, I_{im} — index ratio between the length of intramedian cell and its width, I_{m2} — index ratio between the length of the 2nd median cell and its width, I_{m3} — index ratio between the length of the 3rd median cell and its width, Me — median.

Results and discussion. Using the measurements and indices of fore wings of the net-winged insects, the author proposed the keys to determination of Neuroptera taxa from the Ukrainian Carpathians.

Order NEUROPTERA Linnaeus, 1758

KEY TO UKRAINIAN FAMILIES OF *NEUROPTERA* LINNAEUS, 1758

1 (6) Length to width ratio of fore wing is more than 3 ..... **2**

2 (5) Length of fore wing is more than 3 cm **3**

3 (4) Width of cubital sector makes up nearly ¼ of fore wing width. Veins *Sc* and *R* fused into smooth curve towards the wing tip; distal cell between *R* and *Rs* is elongated, being 4–7 times as long as wide (Fig. 3a). Antennas gradually thickening towards the tip or clavate .... **MYRMELEONTIDAE Latreille, 1803**

4 (3) Width of cubital sector makes up approximately ⅒ of fore wing width. The vein *Sc+R* right after fusing steeply bent backwards; distal cell (Fig. 3b) between *R* and *Rs* short, quadrangular or nearly square, being 1.5 times as long as wide. Antennas clavate, long .... **ASCALAPHIDAE Rambur, 1842**

5 (2) Length of fore wing less than 1.5 cm. Radial sector always includes three cells; *R* vein makes *Rt* (radial triangular) in front of the first *Rs* (Fig. 2). Fore legs are seizing ones. Antennas short, setaceous. Pronotum is longer its width ..... **MANTISPIDAE Leach, 1815**

6 (1) Length to width ratio of fore wing is less than 2.8 ..... **7**

7 (10) Length of fore wing is more than 1.2 cm **8**

8 (9) Wing membrane is transparent, often with dark spots, main veins brownish. Veins *Sc* and *R* are fused gradually (Fig. 5a). Radial sector includes many cross veins. Head with three simple ocelli .... **OSMYLIDAE Leach, 1815**

9 (8) Wing membrane is transparent, without spots, main veins greenish. Veins *Sc* and *R* are fused near the wing tip, or joined by cross veins. Only one branch R_1 originates from *R* vein. Ovipositor is absent ..... **CHRYSOPIDAE Schneider, 1851**

10 (7) Length of fore wing is less than 1 cm **11**

11 (14) Length of fore wing is above 0.6 cm **12**

12 (13) Wing membrane is transparent, often with dark spots or character drawing. *R* and *Sc* are not fused near the wing tip. Fore wing with two or more branches *Rs*; *Sc* and *R* are ended separately. Radial sector includes many cross veins. Numerous *trz* are clearly visible (Fig. 4) .... **HEMEROBIIDAE Latreille, 1803**

13 (12) Wing membrane is transparent, uniformly brownish colored, lacking spots and drawings. Fore wing with only one branch *Rs*. *R* and *Sc* are fused near wing tip. Vein *Sc* is steeply curved before fusion with *R* (Fig. 5b). Radial sector includes few veins. Wing edges lacking *trz* .... **SISYRIDAE Handlirsch, 1908**

14 (11) Length of fore wing is less than 0.5 cm **15**

15 (16) Body and wings are covered with white thing wax-like coating. Wings lacking setae and spots. Venation is simple: few cross veins, not more than 5; costal sector lacking cross veins; longitudinal veins without branching; wing edges without *trz*. Female lacking ovipositor .... **CONIOPTERYGIDAE Burmeister, 1839**

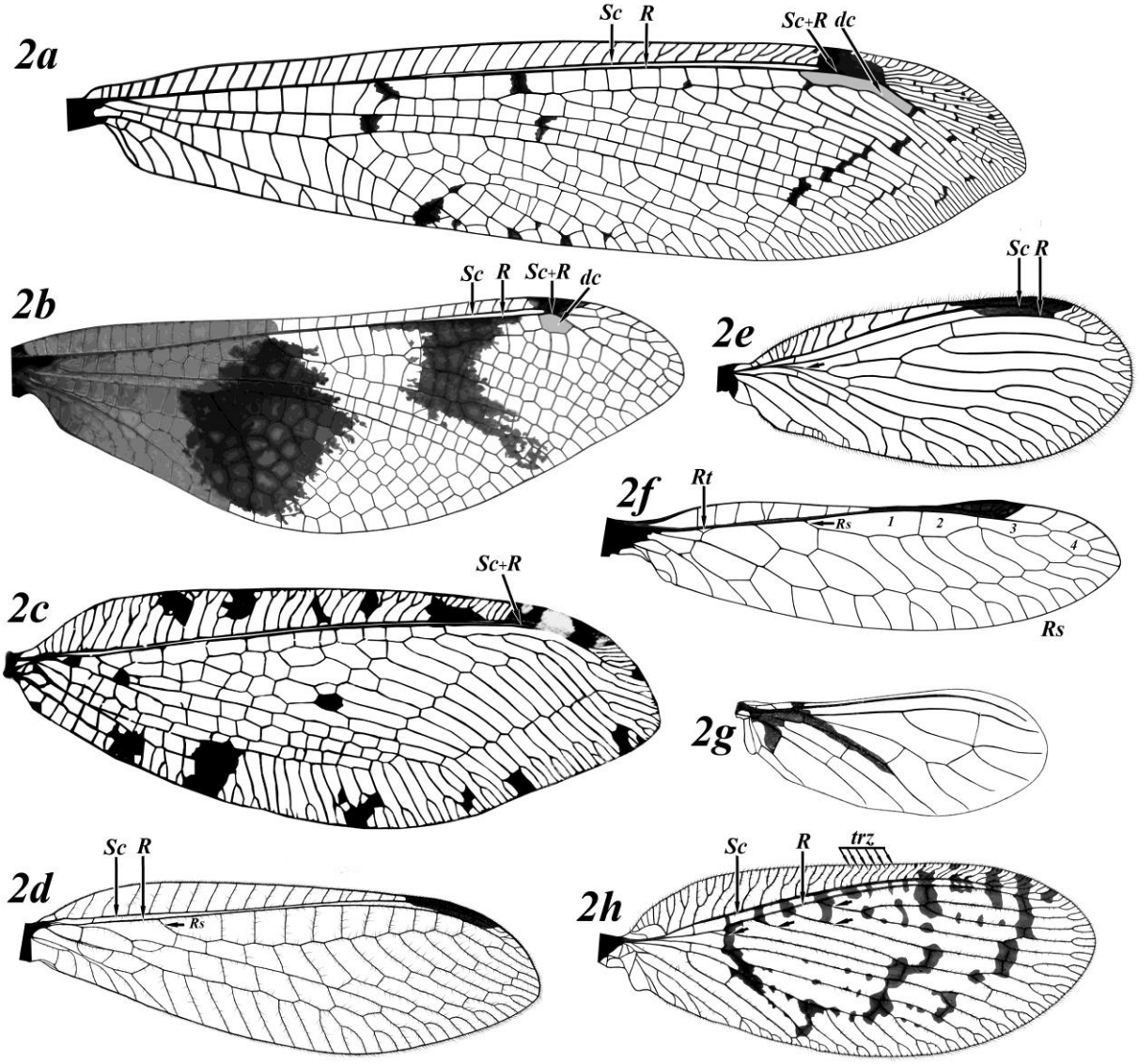
16 (15) Lack of white thing wax-like coating. Wings are brownish colored, covered with long dense setae, as usual with character drawing, which includes numerous brown spots and cross strips. Venation is dense and complex: many cross veins; from the vein *R* five branches are originating *(R_1–R_5)*. Female has a long saber-like ovipositor ..... **DILARIDAE Handlirsch, 1908**

Family CHRYSOPIDAE Schneider, 1851

Diagnosis. Green lacewings (Chrysopidae) are one of the largest families among Neuroptera. There are about 1,300 currently recognized species included in 87 genera and 3 subfamilies in the world. The adults are usually predators, but a few species feed on pollen. The adults have symmetrical mandibles and long setaceous

antennae, which may two times exceed the length of the wing. The wings are large (hind pair of wings slightly smaller than fore one), semi-transparent, iridescent; veins mainly greenish or brownish colored. In contrast to other neuropterans, the chrysopids' wing membrane is without microtrichia and *trz.* The pterostigma in not always visible. Wing veins are covered with setae on both sides, making a dense fringe in some members of the family. Jugulum lobe of the wing is available only in the most primitive species of the family. Wings have the characteristic venation, which is of great value when identifying the taxa (Fig. 1) (Aspöck and Aspöck, 2007; Duelli, 1999; Zakharenko, 1979, 1982).

The family Chrysopidae includes three subfamilies: Apochrysinae, Chrysopinae, and Nothochrysinae. The ranges of the most members of Apochrysinae are restricted within the Southern Hemisphere: seven species of two genera are known from Central and South America; two genera with three species occur in South Africa; five genera with 14 species — in the Australian Region. In the Northern Hemisphere the subfamily is represented by a single species — *Nacaura matsumurae* Okamoto, 1912 from Japan (Toschi, 1965; Winterton and Brooks, 2002).



F i g . 2 . Fore wing venation: a — Myrmeleontidae (*Distoleon* Banks, 1810), b — Ascalaphidae (*Libelloides* Schaffer, 1763), c — Osmylidae (*Osmylus* Latreille, 1802), d — Chrysopidae (*Chrysopa* Leach, 1815), e — Sysiridae (*Sysira* Burmeister, 1839), f — Mantispidae (*Mantispa* Illiger in Kugelann, 1798), g — Conyopterigidae (*Conwentzia* Enderlein 1905), h — Hemerobiidae (*Hemerobius* Linnaeus, 1758); *R* — radius, *Rs* — radial sector, *Rt* — radial triangular, *dc* — distal cell between *R* and *Rs*, *Sc* — subcostal vein; *trz* — the tiny inserted veins, arranged between the terminal branches of longitudinal veins.

KEY TO UKRAINIAN SUBFAMILIES OF CHRYSOPIDAE SCHNEIDER, 1851

1 (2) *Psm* vein of fore wing is zigzag in shape, fusing into inner gradates of cross veins .... **NOTCHOCHRYSINAE Navás, 1910**

2 (1) *Psm* vein of fore wing is strait, fusing into outer gradates of cross veins .... **CHRYSOPINAE Schneider, 1851**

Subfamily NOTHOCHRYSINAE Navás 1910

The species of the subfamily Nothochrysinae are represented in all continents (excluding Antarctica) by seven genera (17 species). Only three species (*Hypochrysa elegans* Burgmeister, 1839, *Nothochrysa capitata* Fabricius, 1793, and *Notochrysa fulvipes* Stephens, 1836) occur in Europe, including Ukraine. The keys to their identification based on fore wing morphology have been published earlier (Aspöck, 1993; Zeleny, 1984).

Subfamily CHRYSOPINAE Schneider, 1851

The subfamily Chrysopinae includes the largest number of species, which occur in all continents (excluding Antarctica), the cosmopolitans being among them. About 65 species in 12 genera are known from Europe (Canard, 2004), including 23 species in eight genera (*Italochrysa, Chrysopa, Chrysoperla, Chrysotropia, Cunctochrysa, Nineta, Peyerimhoffina, Pseudomallada*) from Ukraine (Serediuk, 2015).

KEY TO UKRAINIAN GENERA OF *CHRYSOPINAE* SCHNEIDER, 1851

1 (2) Intramedian cell *(im)* of fore wing is nearly trapeziform (Fig. 4a) .... ***Italochrysa* Principi, 1946**

2 (1) Intramedian cell *(im)* of fore wing is nearly oval-triangular (Fig. 4b–4g) **3**

3 (4) Length of fore wing is above 16 mm. Head and body without dark spots. Setae in costal sector are short and arranged at an acute angle to the costal vein *(C)* ..... ***Nineta* Navás, 1912**

4 (3) Length of fore wing is less than 16 mm **5**

5 (6) Fore wing is narrow, its length is 3.5 times the width. All veins in costal sector are pale colored. Inner gradates include greater number of cross veins, than outer gradates. Abdomen is brownish colored ventrally ..... ***Peyerimhoffina* Lacroix, 1920**

6 (5) Fore wing is broad, its length is 2.5 times the width **6**

7 (8) Long setae along the costal vein *(C)* of fore wing are arranged nearly at right angle to it. Head and thorax homogeneously yellow colored ..... ***Chrysotropia* Navás, 1911**

8 (7) Setae along the costal vein *(C)* of fore wing are arranged at an angle of not more than 60° to it (Fig. 5) **9**

9 (12) Index of length to width ratio in the second cell of radial sector (r_2) is less than 1.8 ..... **10**

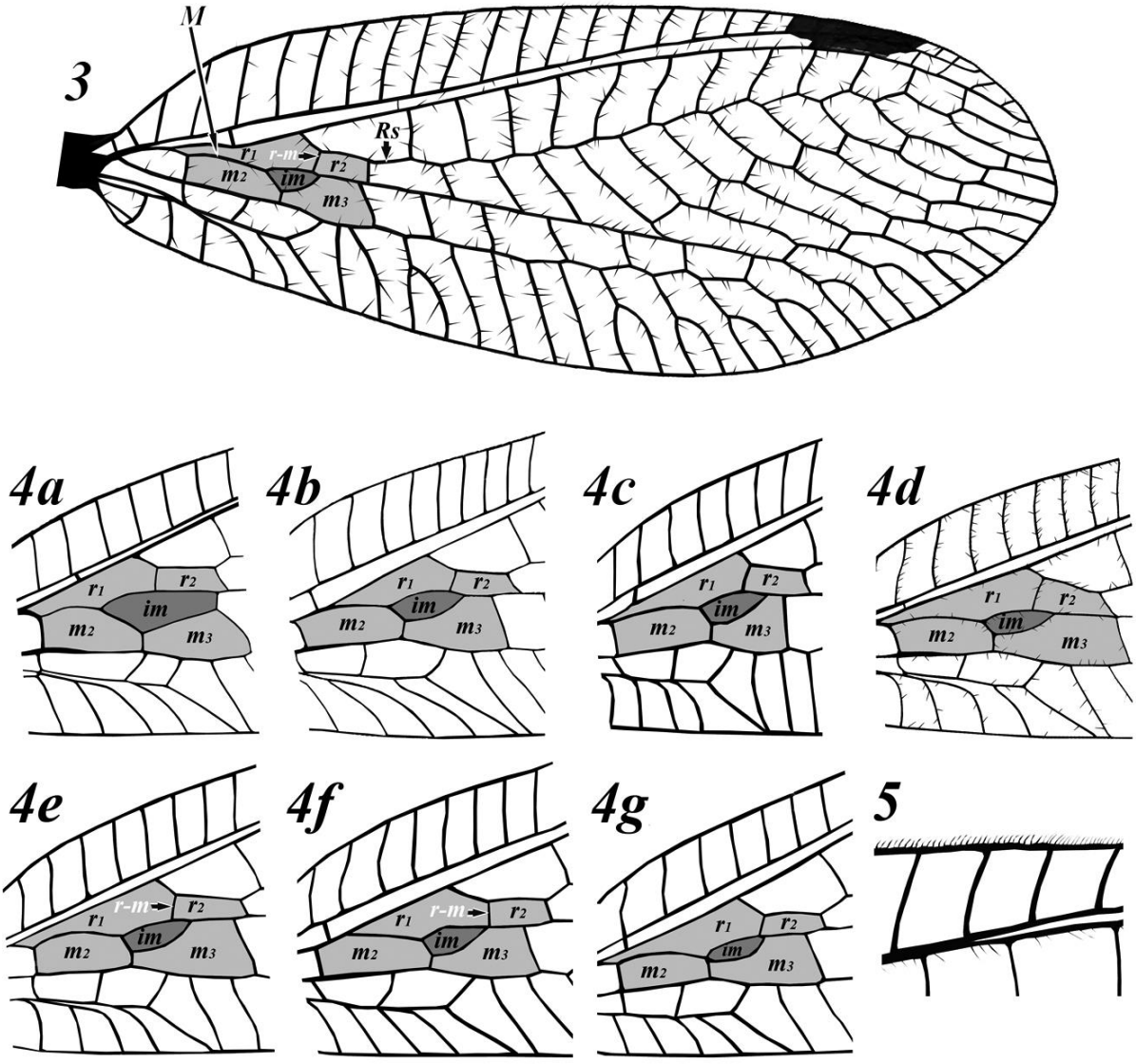
10 (11) The cell m_2 in nearly quadrangular, its length is 2 times the width; the cell m_3 is nearly triangular in shape, its length being almost equal to width (Fig. 4c). Head and sometimes the body with dark spots or drawings ..... ***Chrysopa* Leach in Brewster, 1815**

11 (10) The cell m_2 is nearly quadrangular, its length is 3 times the width; length of cell m_3 is 2 times the width. The cell *im* is nearly oval-triangular, its angles are smoothed down (Fig. 4g). Head and body are without dark spots. Pronotum is covered with long pale hairs .... ***Cunctochrysa* Hölzel, 1970**

12 (9) Index of length to width ratio in the second cell of radial sector (r_2) exceeds 1.8 ..... **13**

13 (14) First cross vein between R_s and $M_{(r\text{-}m)}$ meets the vein *M* before the apex of intramedian cell (Fig. 4e). In the base of costal sector the cross veins are dark colored. Thorax and abdomen without longitudinal dorsal band ..... ***Pseudomallada* Tsukaguchi, 1995**

14 (13) First cross vein between R_s and $M_{(r\text{-}m)}$ meets the vein *M* distally to the apex of intramedian cell or near its top (Fig. 4f). All cross veins in the costal sector are greenish colored. Thorax and abdomen with longitudinal dorsal pale band ..... ***Chrysoperla* Steinmann, 1964**



Figs. 3–5. Fore wing venation of Chrysopidae: 3 — *Chrysotropia* Navás, 1911; 4 — base of fore wing: a — *Italochrysa* Principi, 1946, b — *Nineta* Navas, 1912, c — *Chrysopa* Leach in Brewster, 1815, d — *Peyerimhoffina* Lacroix, 1920, e —*Pseudomallada* Tsukaguchi, 1995, f — *Chrysoperla* Steinmann, 1964, g — *Cunctochrysa* Hölzel, 1970; 5 — fragment of fore wing of *Chrysopa* Leach, 1815, with setae fringe; *M* — median vein, *im* — intramedian cell, m_2 — 2nd median cell, m_3 — 3rd median cell, r_1 — 1st radial cell, r_2 — 2nd radial cell, *r-m* — radial-median vein, *Rs* — radial sector.

Genus *Nineta* Navàs, 1912

Diagnosis. The genus *Nineta* belongs to the family Chrysopidae, tribe Chrysopini. For the first time the genus was distinguished in 1912 by Navàs, who had attributed three species, previously belonging to the genus *Chrysopa*, to a new genus *Nineta*. The species of the genus are characterized by relatively large size of body (mean 20 mm), light-green coloration of body and wings, and availability of clear longitudinal pale band on the dorsum of some species. Fore wings are from 16 to 22 mm long. Head and body are lacking any spots or drawings. Mandibles are symmetrical (Dorokhova, 1987). Male genitalia are not species-specific and cannot be useful in species identification. Although female genitalia are species-specific, the similarity in genital structure in some species (*Nineta flava* Scopoli, 1763, *Nineta guadarramensis* Pictet, 1865, *Nineta principiae* Monserrat,

1980) makes their identification rather complicated (Aspöck, Aspöck and Hölzel, 1980; Brooks, 1997). For this reason the main attention, while providing identification, must be paid to fore wing structure, the species-specific venation in particular.

The results of measurements of these four species of *Nineta* genus are summarized in Table 2.

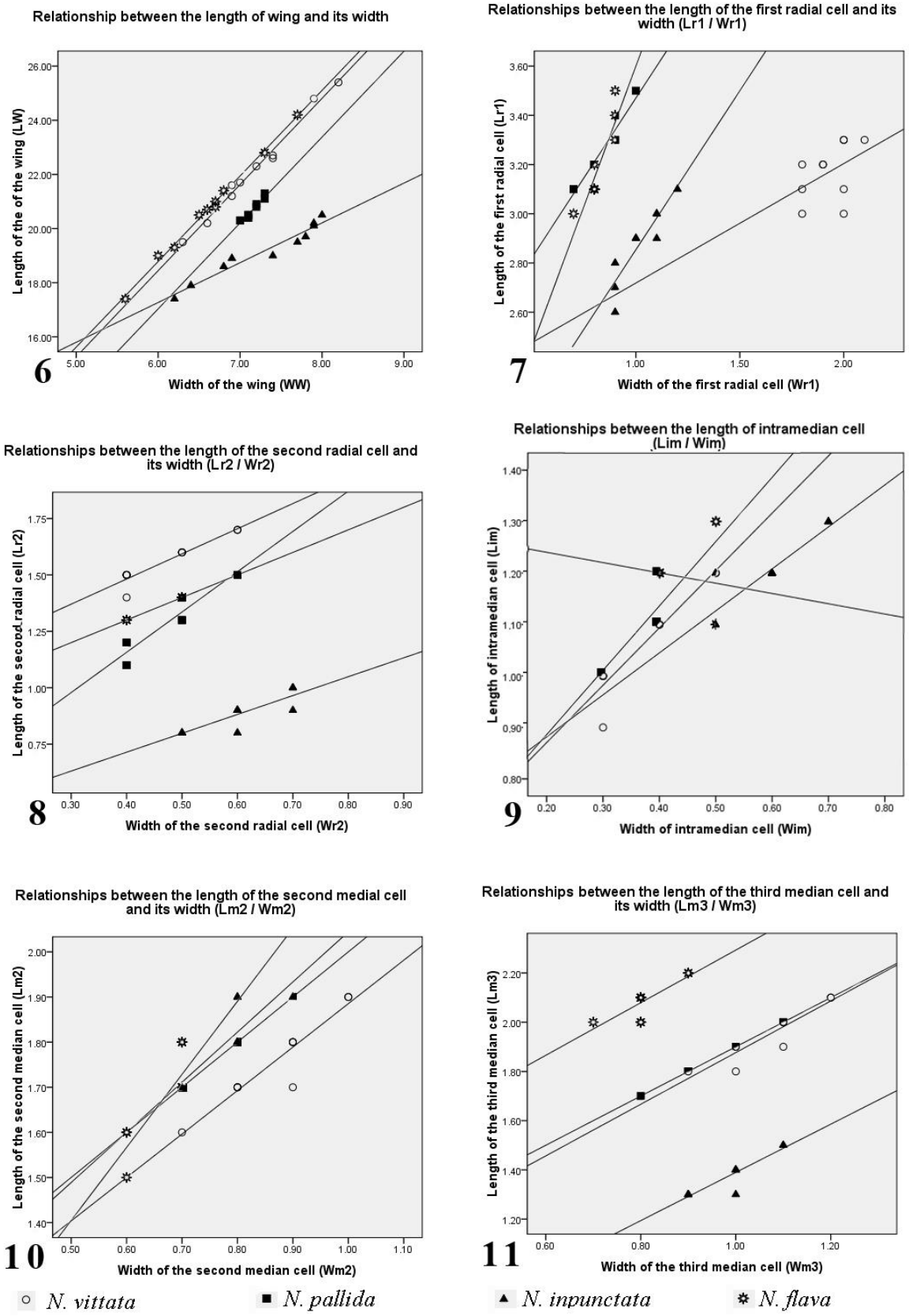
Table 2. Main morphometric characters of fore wing structure in species of the genus *Nineta* from the Ukrainian Carpathians

Species	Results of measurements																				
	n	*W*			*r1*			*r2*			*im*			*m2*			*m3*			AD, °
		length, mm	width, mm	I_W	length, mm	width, mm	I_{r1}	length, mm	width, mm	I_{r2}	length, mm	width, mm	I_{im}	length, mm	width, mm	I_{m2}	length, mm	width, mm	I_{m3}	
N. vittata	1	19.5	6.3	3.10	3.2	1.8	1.78	1.4	0.4	3.50	0.9	0.3	3.00	1.6	0.7	2.29	1.8	0.9	2.00	22.2
	2	20.2	6.6	3.06	3.0	1.8	1.67	1.5	0.4	3.75	1.0	0.3	3.33	1.7	0.8	2.13	1.8	1.0	1.80	22.3
	3	21.2	6.9	3.07	3.1	1.8	1.72	1.5	0.4	3.75	1.0	0.3	3.33	1.7	0.8	2.13	1.9	1.0	1.90	22.2
	4	21.6	6.9	3.13	3.2	1.9	1.68	1.5	0.4	3.75	1.0	0.3	3.33	1.7	0.8	2.13	1.9	1.0	1.90	22.1
	5	21.7	7.0	3.10	3.2	1.9	1.68	1.5	0.4	3.75	1.0	0.3	3.33	1.7	0.9	1.89	1.9	1.1	1.73	22.4
	6	22.3	7.2	3.10	3.3	2.0	1.65	1.6	0.5	3.20	1.1	0.4	2.75	1.8	0.9	2.00	2.0	1.1	1.82	22.5
	7	22.6	7.4	3.05	3.0	2.0	1.50	1.6	0.5	3.20	1.1	0.4	2.75	1.8	0.9	2.00	2.0	1.1	1.82	22.5
	8	22.7	7.4	3.07	3.1	2.0	1.55	1.6	0.5	3.20	1.1	0.4	2.75	1.8	0.9	2.00	2.0	1.1	1.82	22.6
	9	24.8	7.9	3.14	3.3	2.1	1.57	1.7	0.6	2.83	1.2	0.5	2.40	1.9	1.0	1.90	2.1	1.2	1.75	22.8
	10	25.4	8.2	3.10	3.3	2.0	1.65	1.7	0.6	2.83	1.2	0.5	2.40	1.9	1.0	1.90	2.1	1.2	1.75	23.1
	Me	22.00	7.10	3.10	3.20	1.95	1.66	1.55	0.45	3.35	1.05	0.35	2.88	1.75	0.90	2.00	1.95	1.10	1.82	22.45
N. inpunctata	1	17.4	6.2	2.81	2.6	0.9	2.89	0.8	0.5	1.60	1.1	0.5	2.20	1.7	0.7	2.43	1.3	0.9	1.44	10.9
	2	17.9	6.4	2.80	2.7	0.9	3.00	0.8	0.5	1.60	1.1	0.5	2.20	1.7	0.7	2.43	1.3	0.9	1.44	10.9
	3	18.6	6.8	2.74	2.8	0.9	3.11	0.8	0.6	1.33	1.2	0.5	2.40	1.7	0.7	2.43	1.3	0.9	1.44	10.9
	4	18.9	6.9	2.74	2.9	1.0	2.90	0.9	0.6	1.50	1.2	0.6	2.00	1.8	0.8	2.25	1.3	1.0	1.30	11.0
	5	19.0	7.4	2.57	2.9	1.0	2.90	0.9	0.6	1.50	1.2	0.6	2.00	1.8	0.8	2.25	1.4	1.0	1.40	11.0
	6	19.7	7.8	2.53	2.9	1.1	2.64	0.9	0.6	1.50	1.2	0.6	2.00	1.8	0.8	2.25	1.4	1.0	1.40	11.0
	7	19.5	7.7	2.53	2.9	1.0	2.90	0.9	0.6	1.50	1.2	0.6	2.00	1.8	0.8	2.25	1.4	1.0	1.40	11.1
	8	20.1	7.9	2.54	3.0	1.1	2.73	0.9	0.7	1.29	1.2	0.6	2.00	1.9	0.8	2.38	1.4	1.0	1.40	11.2
	9	20.5	8.0	2.56	3.1	1.2	2.58	1.0	0.7	1.43	1.3	0.7	1.86	1.9	0.9	2.11	1.5	1.1	1.36	11.3
	10	20.2	7.9	2.56	3.0	1.1	2.73	1.0	0.7	1.43	1.3	0.7	1.86	1.9	0.8	2.38	1.5	1.1	1.36	11.2
	Me	19.25	7.55	2.57	2.90	1.00	2.89	0.90	0.60	1.50	1.20	0.60	2.00	1.80	0.80	2.31	1.40	1.00	1.40	11.00
N. pallida	1	20.3	7.0	2.90	3.1	0.7	4.43	1.1	0.4	2.75	1.0	0.3	3.33	1.7	0.7	2.43	1.7	0.8	2.13	11.3
	2	20.3	7.0	2.90	3.1	0.7	4.43	1.1	0.4	2.75	1.0	0.3	3.33	1.7	0.7	2.43	1.8	0.9	2.00	11.4
	3	20.4	7.1	2.87	3.2	0.8	4.00	1.2	0.4	3.00	1.1	0.4	2.75	1.7	0.7	2.43	1.8	0.9	2.00	11.4
	4	20.4	7.1	2.87	3.2	0.8	4.00	1.2	0.4	3.00	1.1	0.4	2.75	1.7	0.7	2.43	1.8	0.9	2.00	11.4
	5	20.5	7.1	2.89	3.2	0.8	4.00	1.3	0.5	2.60	1.1	0.4	2.75	1.8	0.8	2.25	1.9	1.0	1.90	11.5
	6	20.5	7.1	2.89	3.2	0.8	4.00	1.3	0.5	2.60	1.1	0.4	2.75	1.8	0.8	2.25	1.9	1.0	1.90	11.5
	7	20.8	7.2	2.89	3.3	0.9	3.67	1.4	0.5	2.80	1.1	0.4	2.75	1.8	0.8	2.25	1.9	1.0	1.90	11.6
	8	20.9	7.2	2.90	3.3	0.9	3.67	1.4	0.5	2.80	1.1	0.4	2.75	1.8	0.8	2.25	1.9	1.0	1.90	11.7
	9	21.1	7.3	2.89	3.4	0.9	3.78	1.5	0.6	2.50	1.2	0.4	3.00	1.9	0.9	2.11	2.0	1.1	1.82	11.8
	10	21.3	7.3	2.92	3.5	1.0	3.50	1.5	0.6	2.50	1.2	0.4	3.00	1.9	0.9	2.11	2.0	1.1	1.82	11.8
	Me	20.50	7.10	2.89	3.20	0.80	4.00	1.30	0.50	2.75	1.10	0.40	2.75	1.80	0.80	2.25	1.90	1.00	1.90	11.50
N. flava	1	17.4	5.6	3.11	3.0	0.7	4.29	1.4	0.5	2.80	1.1	0.5	2.20	1.5	0.6	2.50	2.0	0.7	2.86	11.3
	2	19.0	6.0	3.17	3.1	0.8	3.88	1.4	0.5	2.80	1.1	0.5	2.20	1.6	0.6	2.67	2.0	0.8	2.50	11.3
	3	19.3	6.2	3.11	3.1	0.8	3.88	1.4	0.5	2.80	1.1	0.5	2.20	1.6	0.6	2.67	2.0	0.8	2.50	11.4
	4	20.5	6.5	3.15	3.1	0.8	3.88	1.4	0.5	2.80	1.2	0.4	3.00	1.7	0.7	2.43	2.1	0.8	2.63	11.4
	5	20.7	6.6	3.14	3.1	0.8	3.88	1.4	0.5	2.80	1.2	0.4	3.00	1.7	0.7	2.43	2.1	0.8	2.63	11.3
	6	20.8	6.7	3.10	3.1	0.8	3.88	1.4	0.5	2.80	1.2	0.4	3.00	1.7	0.7	2.43	2.1	0.8	2.63	11.4
	7	21.0	6.7	3.13	3.2	0.8	4.00	1.4	0.5	2.80	1.2	0.4	3.00	1.7	0.7	2.43	2.1	0.8	2.63	11.5
	8	21.4	6.8	3.15	3.3	0.9	3.67	1.3	0.4	3.25	1.2	0.4	3.00	1.7	0.7	2.43	2.1	0.8	2.63	11.5
	9	22.8	7.3	3.12	3.4	0.9	3.78	1.3	0.4	3.25	1.3	0.5	2.60	1.8	0.7	2.57	2.2	0.9	2.44	11.3
	10	24.2	7.7	3.14	3.5	0.9	3.89	1.4	0.5	2.80	1.3	0.5	2.60	1.8	0.7	2.57	2.2	0.9	2.44	11.4
	Me	20.75	6.65	3.14	3.10	0.80	3.88	1.40	0.50	2.80	1.20	0.45	2.80	1.70	0.70	2.46	2.10	0.80	2.63	11.40

Remark. Designations — as in Table 1.

Results of the measurements are compared on the graphs below (Figs. 6–11).

These graphic drawings show the results of the preliminary data analysis from the Table 2. It is evident that not all indices are equally important to distinguish each of four species one from another.



Figs. 6–11. Relationship between venation structures of fore wings in different *Nineta* species: 6 — wings, 7 — r_1, 8 — r_2, 9 — *im*, 10 — m_2, 11 — m_3.

For instance, the distinguishing of *Nineta* species by using the index I_{im} only is impossible, as clear difference between sizes of intramedian cell in all species is lacking (Fig. 9). At the same time, the index I_{m2} is useful in distinguishing the only species — *N. vittata* (Fig. 10). Plotting of index ratio in the third median cell (I_{m3}) shows that m_3 cells in *Nineta* species delimit into three clusters, enabling to distinguish *N. inpunctata* and *N. flava*, two other species remaining indistinguishable (Fig. 11). Using of both indices I_{r1} or I_{r2} enables to identify *N. vittata* and *N. inpunctata* with high reliability (Figs. 7–8). In the case of *N. pallida*, while its identification by index ratios in all considered cells is problematic one, the use of the length to width ratio in fore wing (I_W) enables reliable identification (Fig. 11).

In that way, it is impossible to use all indices synchronously, as part of them has the same value for certain species (Fig. 12). However, as each species among the studied ones differs from others at least by one parameter in wing venation, and hence by certain index ratio, the use of indices in species identification can be effective enough. Note should be taken, that some indices not always play the main part in species identification. For example, using of the index I_{im}, has failed to distinguish any of the species studied with high reliability (see above). However, the shape of intramedian cells in *Nineta* species has specific differences, what can serve as important diagnostic character (Figs. 13–16).

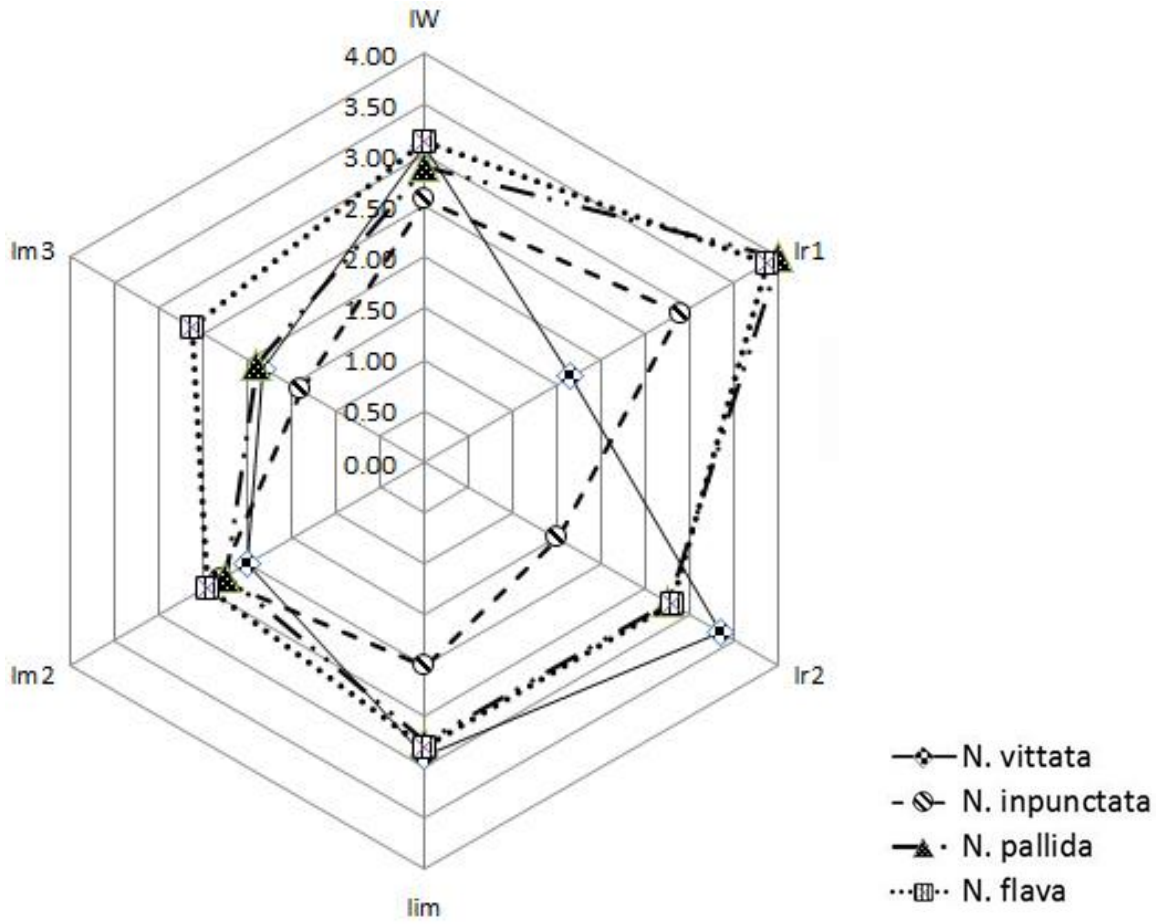
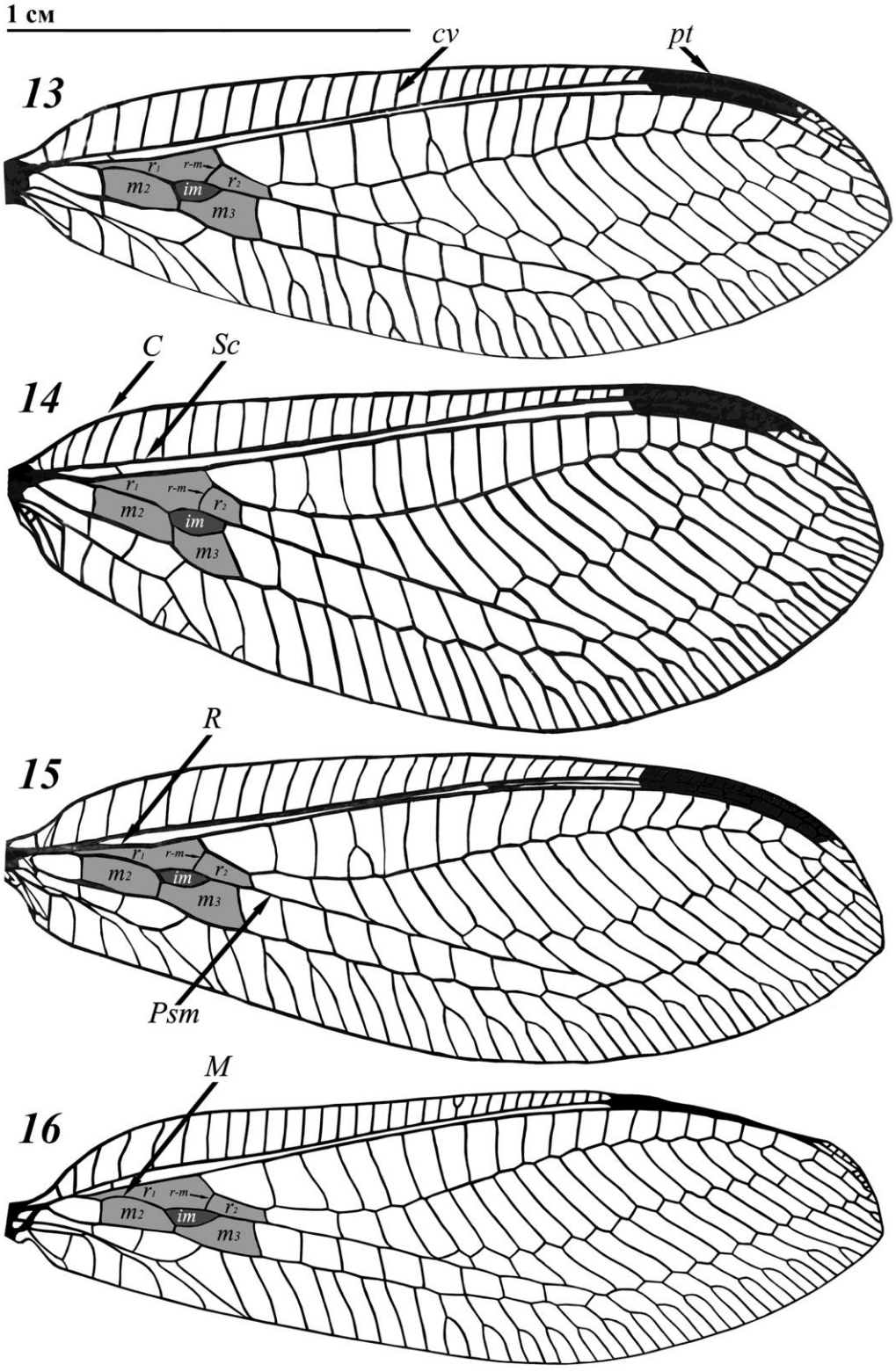


Fig. 12. Comparison of fore wing venation indices of the *Nineta* species from the Ukrainian Carpathians.

At present, the genus *Nineta* in the Holarctic includes 18 species, seven of which occur in Europe (first four from those also occur in Ukraine): *N. flava* (Scopoli, 1763), *N. vittata* Wesmael, 1841, *N. pallida* Schneider, 1846, *N. inpunctata* Reuter, 1894, *N. guadarramensis* Pictet, 1865, *N. principiae* Monserrat, 1980, *N. carinthiaca* Hölzel, 1965 (Canard, 2004).

Some data on four species of the genus *Nineta*, including their European distribution, new findings in Ukraine (the Ukrainian Carpathians), ecological characteristics, and a key to identification, are stated below. The notes these four species from the Eastern Carpathians by Babidorich (1993) lacks precise information on the material collected.



Figs. 13–16. Fore wing venation: 13 — *Nineta vittata*, 14 — *N. inpunctata*, 15 — *N. pallida*, 16 — *N. flava*; *C* — costal vein, *M* — median vein, *Psm* — pseudomedian vein, *R* — radius, *Sc* — subcostal vein, *im* — intramedian cell, r_1 — first radial cell, r_2 — second radial cell, *r-m* — radial-median vein, m_2 — second median cell, m_3 — third median cell, *cv* — cross veins of costal sector, *pt* — pterostigma.

KEY TO UKRAINIAN SPECIES OF *NINETA* NAVÁS, 1912

1 (6) Costal sector of fore wing gradually grows narrow towards the wing tip **2**

2 (4) Length of fore wing is 2 times the width **3**

3 (5) Costal sector includes less than 40 cells. Veins of costal sector, cross veins between *Sc* and *Rs*, all veins in the base of the wing, and series of cross veins are black colored. Pterostigma covers less than eight cells of costal sector and corresponding part of *Sc* sector. Length to width ratio in the first radial cell *(r_1)* is 3:1, in the second radial cell *(r_2)* — 2:1 (Fig. 14). Fore wing is 17–20 mm long. Antennal scape is slightly longer its width ..... ***N. inpunctata* Reuter, 1894**

4 (2) Length of fore wing is 3 times the width. Costal sector includes at least 40 cells or more. Pterostigma covers more than eight cells of the costal sector and corresponding part of *Sc* sector. Length to width ratio in the first radial cell *(r_1)* is 5:1, in the second radial cell *(r_2)* — 3:1 (Fig. 13). Antennal scape is nearly cylindrical in shape, its length is 2 times the width. Fore wing is 17–25 mm long ..... ***N. vittata* Wesmael, 1841**

5 (3) Costal sector includes more than 45 cells. All main and cross veins are pale colored. Pterostigma covers about 20 cells of costal sector and corresponding part of *Sc* sector. Length to width ratio in the first radial cell *(r_1)* is 4:1 (Fig. 15), in the second radial cell *(r_2)* — 3:1. Fore wing vein *Psm* is black. Fore wing is 17–24 mm long ..... ***N. pallida* Schneider, 1846**

6 (1) Costal sector of fore wing sharply grows narrow in its middle part towards the wing tip. Costal sector includes less than 35 cells. Main veins are green colored. Pterostigma covers more than 10 cells of costal sector and corresponding part of *Sc* sector. Median sector includes 8–9 cells. Length to width ratios in both radial cells *(r_1, r_2)* are 4:1 (Fig. 16). Fore wing is 16–25 mm long ..... ***N flava* (Scopoli, 1763)**

Nineta vittata (Wesmael, 1841)

= *Chrysopa vittata* Wesmael, 1841, = *Hemerobius proximus* Rambur, 1842, = *Chrysopa intergo* Hagen, 1852, = *Nothochrysa divacea* Gerttäcker, 1894, = *Parachrysa divacea* Gerttäcker, 1915, = *Chrysocerca vittata* Wesmael, 1924

References. Aspöck, Aspöck and Hölzel, 1980; Aspöck, Hölzel and Aspöck, 2001; Serediuk, 2013, 2015.

This forest species, widely distributed in the Palaearctic, inhabits the foliage trees and shrubs. The ontogenesis commonly takes place on shrubs and young growth (most often *Corylus*, *Fagus*, *Acer*). Adults are phytophagous, staying on vegetation of forest gaps in search of nectar or pollen. In mountains, it occurs up to 1,300 m a. s. l. Population density is stable enough and always low. In conditions of Ukraine it is commonly univoltine (by Aspöck, Aspöck and Hölzel (1980) — also bivoltine). Most possible that the species enters hibernation on pupa or prepupa stages. Emergence from hibernation begins in the late April, flight period lasts from the middle of May to September–October.

Material. Ukraine, the Transcarpathian Lowland: Rakhiv, 22.06.1998 — 1 ♀ (V. O. Chumak), 26.07.1998 — 1 ♂ (V. O. Chumak); Dilove, 24.06.1998 — 1 ♀ (V. O. Chumak); Mala Uholka, 15.06.2011 — 1 ♀ (H. V. Serediuk), 11.06.2012 — 1 ♀ (H. V. Serediuk); Ivano-Frankivsk Region: Mykulytchyn, 18.07.2015 — 1 ♀ (H. V. Serediuk) (Serediuk, 2013, 2015).

Distribution. Europe and Northern Asia eastward to the Pacific (Aspöck, Aspöck and Hölzel, 1980).

Nineta inpunctata (Reuter, 1894)

= *Chrysopa septempunctata* Reteuter, 1894, = *Chrysopa inpunctata* Hölzel, 1965, = *Nineta reuteri* Tjeder, 1967, = *Nineta impunctata* Gepp, 1978

References. Aspöck, Aspöck and Hölzel, 1980; Serediuk, 2013, 2015.

The species occurs in mixed forest from lowlands to 1,400 m a. s. l. Its biology has been studied insufficiently. Flight of adults is relatively short, in May–July. Adults are known to fly towards the artificial lights. Rare species.

Material. Ukraine, the Transcarpathian Lowland: near Luh, 'Kuzij' forestry, 13.07.2015 — 1 ♂ (H. V. Serediuk); Luh, 12.07.2014 — 1 ♂ (H. V. Serediuk); Mala Uholka, 25.07.2011 — 1 ♂; Rakhiv, 26.07.1998 — 1 ♀ (V. O. Chumak); Ivano-Frankivsk Region: near Maksymets, 'Gorgany' forestry — 1 ♀ (H. V. Serediuk) (Serediuk, 2013, 2015).

Distribution. Northern and Central Europe (Aspöck, Aspöck and Hölzel, 1980).

***Nineta pallida* (Schneider, 1846)**

= *Chrysopa pallida* Schneider, 1851, = *Nineta pallida* Eglin, 1940, = *Chrysopa pallida* Holzel, 1965

References. Dzięddzielewicz, 1905; Aspöck, Aspöck and Hölzel, 1980; Serediuk, 2013, 2015.

The species is common inhabitant of mountain coniferous forests. In Europe occurs from lowlands to an altitude of 1,700 m a. s. l. (Zeleny, 1984). Some localities show a high density of species population. Flight of adults begins in late June–early July and lasts to the middle of October. The species is univoltine.

Material. Ukraine, the Transcarpathian Lowland: Mala Uholka, 21.06.2012 — 1 ♀ (H. V. Serediuk); Ivano-Frankivsk Region: Mykulytchyn, 20.07.1902 — 1 ♂ (J. Dzięddzielewicz), 18.07.2015 — 1 ♀ (H. V. Serediuk); Khomiak Mt., 15.08.2015 — 1 ♂ (H. V. Serediuk), 16.08.2015 — 1 ♂ (H. V. Serediuk); Lviv Region: Krushelnytsia, 09.08.2015 — 3 ♂♂ (H. V. Serediuk) (Serediuk, 2013, 2015).

Distribution. Central and South Europe; North Asia eastward to the Pacific; Japan (Aspöck, Aspöck and Hölzel, 1980).

***Nineta flava* (Scopoli, 1763)**

= *Hemerobius flavus* Scopoli, 1763, = *Chrysopa subfalcata* Stephens, 1836, = *Chrysopa flava* Hagen, 1858, = *Nineta flava* Navas, 1912, = *Chrysocerca flava* Lacroix, 1924, = *Chrysopa flava* Hölzel, 1965

References. Aspöck, Aspöck and Hölzel, 1980; Canard, 1984; Serediuk, 2013, 2015; Zakharenko, 1993.

The species most often occurs in sparse forest stands with humid, light and warm conditions. It can also be found in parks and gardens. Adults are phytophagous. The ontogenesis takes place mainly on shrubs, sometimes on deciduous trees. In mountains, it occurs up to the Subalpine (Aspöck, Aspöck and Hölzel, 1980). We have found the species nearly at 1,000 m a. s. l. In favorable conditions densely inhabits the most suitable plots of area. Hibernation takes place on the pupa stage. Commonly the species is bivoltine. The swarming of adults begins in May and lasts till September.

Material. Ukraine, the Transcarpathian Lowland: Mala Uholka, 11.06.2012 — 2 ♂♂, 1 ♀ (H. V. Serediuk); near Luh, 'Kuzij' forestry, 25.08.2014 — 1 ♂ (H. V. Serediuk); Ivano-Frankivsk Region: Halytch, 07.06.2014 — 1 ♂ (H. V. Serediuk) (Serediuk, 2015).

Distribution. All Europe; Turkey, Armenia, Iran (Aspöck, Aspöck and Hölzel, 1980).

Conclusions. The identification of neuropteran taxa based on the morphological structure of fore wings has some advantages. In particular, such an approach enables not to make the detailed examination of anatomical structure of insect body with preliminary preparation, what facilitates the field research.

The availability of any differences in indices of wing structures is obvious enough in all neuropteran taxa. Thus, it may be possible to use the morphometric method based on fore wing venation for identification of various genera and species of Neuroptera, compiling more precise keys.

The proposed keys may be useful both to naturalists, students, agricultural entomologists, and to scientists-neuropterologists. The identification of species by wing structure is more reliable than by outer morphological characters of body. However, when the species identification by the wing venation only is impossible because of natural morphological deformations, the body of insect needs the preparation procedure.

Acknowledgements. The author is much obliged to Yu. Geriak (Entomological Society of the Western region of Ukraine) and V. Chumak (Uzhorod National University) for providing material, to Yu. Guglya (Museum of Nature of the Vasyl Karazyn Kharkiv National University) for placing the neuropteran collections at our disposal, to P. Duelli (Swiss Federal Research Institute WSL, Birmensdorf, Switzerland) for verifying a part of the processed material, to V. Rizun (State Museum of Natural History of the National Academy of Sciences of Ukraine) for valuable advice, concerning our research, to O. Shatrovskiy (Kharkiv State Zooveterinary Academy) for assistance in preparing the paper to publication, and to I. Konovalova (State Museum of Natural History of the National Academy of Sciences of Ukraine) for assistance in preparing the English version of the paper.

REFERENCES

Aspöck, H., Aspöck, U. and Hölzel, H. (1980) *Die Neuropteren Europas: eine zusammenfassende Darstellung der Systematik, Ökologie und Chorologie der Neuropteroidea (Megaloptera, Raphidioptera, Planipennia) Europas: Bände 1–2*. Krefeld: Goecke & Evers. ISBN: 3872630288. [in German].

Aspöck, H., Hölzel, H. and Aspöck, U. (2001) 'Kommentierter Katalog der Neuropterida (Insecta: Raphidioptera, Megaloptera, Neuroptera) der Westpaläarktis', *Denisia*, 2, pp. 1–606. URL: http://www.zobodat.at/pdf/DENISIA_0002_0001-0606.pdf. [in German].

Aspöck, U. (1993) 'Geklärtes und Ungeklärtes im System der Neuroptera (Insecta: Holometabola)', *Mitteilungen der Deutschen Gesellschaft für Allgemeine und Angewandte Entomologie*, 8, pp. 451–456. [in German].

Aspöck, U. and Aspöck, H. (2007) 'Verbliebene Vielfalt vergangener Blüte. Zur Evolution, Phylogenie und Biodiversität der Neuropterida (Insecta: Endopterygota)', *Denisia*, 20, pp. 451–516. URL: http://www.zobodat.at/pdf/DENISIA_0020_0451-0516.pdf. [in German].

Babidorich, M. M. (1993) 'Green lacewings of the Eastern Carpathians' [Zlatoglazki Vostochnykh Karpat], *Proceeding of the International Conference 'Fauna of the Eastern Carpathians: current status and protection' [Materialy mezhdunarodnoy konferentsii 'Fauna Vostochnykh Karpat: sovremennoe sostoyanie i okhrana']*, Uzhgorod, pp. 98–99. [in Russian].

Brooks, S. J. (1997) 'An overview of the current status of Chrysopidae (Neuroptera) systematics', *Deutsche Entomologische Zeitschrift*, 44(2), pp. 267–275. DOI: 10.1002/mmnd.19970440212.

Canard, M. (1984) 'Écologie des Pontes de *Nineta flava* (Scopoli) (Neuroptera, Chrysopidae): Disposition et Facteurs biotiques antagonistes', in: Gepps, J., Aspöck, H. and Hölzel, H. (eds.) *Progress in World's Neuropterology*. Graz, pp. 253–260. URL: http://www.zobodat.at/pdf/MONO-ENT-NEURO_MEN1_0253-0260.pdf. [in French].

Canard, M. (2004) 'World distribution of the genus *Nineta* Navás 1912 (Neuroptera: Chrysopidae) with some taxonomic notes', *Denisia*, 13, p. 153–161. URL: http://www.zobodat.at/pdf/DENISIA_0013_0153-0161.pdf.

Dorokhova, G. I. (1987) 'Order Neuroptera — Lacewings', in: Medvedev, G. S. (ed.). *Key to the insects of European part of USSR. Volume IV. Megaloptera, Raphidioptera, Neuroptera, Mecoptera and Trichoptera. Part six [Opredelitel' nasekomykh evropeyskoy chasti SSSR. Tom IV. Bol'shekrylye, verblyudki, setchatokrylye, skorpionovye mukhi i rucheyniki. Shestaya chast']*. Leningrad: Nauka, pp. 36–96. [in Russian].

Duelli, P. (1999) 'Honigtau und stumme Gesänge: Habitat- und Partnersuche bei Florfliegen (Neuroptera: Chrysopidae)', *Stapfia*, 60, pp. 35–48. URL: http://www.zobodat.at/pdf/STAPFIA_0060_0035-0048.pdf. [in German].

Dzięd̨zielewicz, J. (1905) 'Sieciarki (Neuroptera genuina) i Prasiatnice (Archiptera) zebrane w ciągu lat 1902 i 1903', Sprawozdanie Komisyi Fizyograficznej, 38(2), pp. 104–125. URL: https://archive.org/details/mobot31753002119763. (in Polish).

Hölzel, H. (1984) 'Chrysopidae of the Palearctic Region — a review', in: Gepps, J., Aspöck, H. and Hölzel, H. (eds.) *Progress in World's Neuropterology*. Graz, pp. 61–68. URL: http://www.zobodat.at/pdf/MONO-ENT-NEURO_MEN1_0061-0068.pdf.

Serediuk, H. V. (2013) 'Neuroptera (Insecta, Neuroptera) of beech forests in Uholka array of Carpathian Biosphere Reserve' [Sitchastokryli (Insecta, Neuroptera) bukovykh pralisiv Uholskoho masyvu Karpatskoho biosfernoho zapovidnyka], *Scientific Bulletin of the Uzhhorod University [Naukovyi visnyk Uzhhorodskoho universytetu]*, 35, pp. 92–96. [in Ukrainian].

Seredyuk, G. V. (2015) 'Green lacewings (Insecta: Neuroptera, Chrysopidae) fauna of Ukraine' [Zolotoochky (Insecta: Neuroptera, Chrysopidae) fauny Ukrainy], *Proceeding of the State Natural History Museum [Naukovi zapysky Derzhavnoho pryrodoznavchoho muzeiu]*, 31, pp. 141–148. URL: http://nbuv.gov.ua/UJRN/Nzdpm_2015_31_18. [in Ukrainian].

Toschi, C .A. (1965) 'The taxonomy, life histories, and mating behavior of the green lacewings of Strawberry Canyon (Neuroptera, Chrysopidae)', *Hilgardia*, 36, pp. 391–433. DOI: 10.3733/hilg.v36n11p391.

Winterton, S. L. and Brooks, S. J. (2002) 'Phylogeny of the apochrysine green lacewings (Neuroptera: Chrysopidae: Apochrysinae)', *Annals of the Entomological Society of America*, 95, pp. 16–28. doi: 10.1603/0013-8746(2002)095[0016:POTAGL]2.0.CO;2.

Zakharenko, A. V. (1979) 'Keys to the economically important species of Neuroptera of Ukraine' [Opredelitel'nye tablitsy khozyaystvenno vazhnykh vidov setchatokrylykh Ukrainy], *Collection of Scientific Works of the Kharkov Agricultural Institute [Sbornik nauchnykh trudov Khar'kovskogo sel'skokhozyaystvennogo instituta]*, 256, pp. 17–24. [in Russian].

Zakharenko, A. V. (1982) 'About fauna and practical importance of Neuroptera of Ukraine' [O faune i prakticheskom znachenii setchatokrylykh Ukrainy], *Collection of Scientific Works of the Kharkov Agricultural Institute [Sbornik nauchnykh trudov Khar'kovskogo sel'skokhozyaystvennogo instituta]*, 282, pp. 20–24. [in Russian].

Zakharenko, A. V. (1993) 'The green lace-wings (Neuroptera, Chrysopidae) of Ukraine' [Zlatoglazki (Neuroptera, Chrysopidae) Ukrainy], *The Kharkov Entomological Society Gazette [Izvestiya Khar'kovskogo entomologicheskogo obshchestva]*, 1(1), pp. 44–58. URL: http://nbuv.gov.ua/UJRN/Vkhet_1993_1_1_7. [in Russian].

Zakharenko, O. V. (1997) *'Lacewings (Insecta, Neuroptera) of Ukraine and some consideration about protection of rare and nearly extinct insects' [Sitchastokryli (Insecta, Neuroptera) Ukrainy i deiaki pytannia okhorony ridkisnykh i znykaiuchykh komakh]*. The dissertation thesis for the scientific degree of the doctor of biological sciences. Kyiv: National Agrarian University. [in Ukrainian].

Zeleny, J. (1984) 'Chrysopid occurrence in West Palearctic temperate forests and derived biotopes', in: Canard, M., Semeria, Y. and New. T. R. (eds.) Biology of Chrysopidae. The Hague: Dr. W. Junk Publishers, pp. 151–160.

Zhang, Z.-Q. (2013) 'Animal biodiversity: An update of classification and diversity in 2013. In: Zhang, Z.-Q. (ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness (Addenda 2013)', *Zootaxa*, 3703(1), pp. 5–11. DOI: 10.11646/zootaxa.3703.1.3.

State Museum of Natural History of National Academy of Sciences of Ukraine