

Nemestrinid Flies (Diptera, Nemestrinidae) in the Fauna of Eastern Europe and the Caucasus

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Received May 16, 2006

Abstract—The ranges of eight species [*Fallenia fasciata* (Fabricius, 1805), *Neorhynchocephalus tauscheri* (Fischer, 1812), *Nemestrinus caucasicus* (Fischer, 1806), *N. bombiformis* Portschinsky, 1892, *N. brandti* (Bequaert, 1938), *N. laetus obscuripennis* (Portschinsky, 1887), *N. reticulatus* Latreille, 1802, and *Trichopsidea costata* (Loew, 1875)] from Eastern Europe and the Caucasus are discussed. With the exception of *Nemestrinus caucasicus*, the other species are rare in the territory studied; their latest findings are referred to the late nineteenth and early twentieth centuries. These species should be considered as endangered species and included into the Red Data Books of the corresponding regions. *N. obscuripennis* (Portschinsky, 1887) is regarded as a Caucasian-Anatolian subspecies of *N. laetus* (Loew, 1873) basing on the study of lecto- and paratypes of the former. A key for identification of the genera and species considered is given.

DOI: 10.1134/S0013873807080143

Nemestrinid flies (Nemestrinidae) are spread worldwide, but are more numerous in the tropics and subtropics, in particular, in South America and Australia. The small family Nemestrinidae belongs to the suborder Brachycera-Orthorrhapha. Seventy seven species are known from the Palaearctic, especially from the southern parts of the region (Richter, 1988). Nemestrinids are large, well-visible flies with the body 10–18 mm long, frequently possessing a very long proboscis and densely pubescent body. They are rather brightly colored; their body is occasionally densely pubescent. In the majority of species, the proboscis is long, with narrow sucking lobes (labella), directed forward or downward. Nemestrinids are heliophilic and thermophilic insects dwelling mainly under arid conditions: semideserts and xerophytic habitats in the mountains. Many species possess narrow ranges. Flies feed on flower nectar and bangle above flowering plants with buzzing noise. In insects from collections, the body is frequently covered with pollen, testifying to participation of these flies in the cross-pollination of plants. Together with other Brachycera (Bombyliidae, some Acroceridae), Hymenoptera (bees, bumblebees), and Lepidoptera, nemestrinids are pollinators of zygomorphic flowers with long tubular corollas. The larval mode of life is known for a few species. Larvae are inner parasites of orthopteroid insects (Orthoptera) and lamellicorn beetles (Coleoptera, Scarabaeidae) at all the stages of their development (excluding the egg).

The development of nemestrinids is complicated, characterized by hypermetamorphosis. Females freely lay an enormous number of eggs (up to 5000) on trunks and branches of trees and on grass stems. All the nemestrinids are *r*-strategists. An emerged larva (of the planidium type) independently finds its host; larvae can stay without food for a long time. When the host is found, the larva penetrates inside it, molts, and starts to feed on the host body. Respiration occurs via a long and narrow respiratory tube. Pupation occurs outside the host body. Nemestrinidae are easily distinguished by the original venation with parallel radial and median veins, bent toward the anterior margin and the specific diagonal vein composed of sectors of different veins. The diagonal vein reaches the wing margin or terminates before it. The space between parallel radial veins can be divided into cells by secondary veins.

In Russia, the fauna of Nemestrinidae was not studied thoroughly, although some species were described from this territory (Fischer, 1806, 1812; Portschinsky, 1881, 1892). Brief notes are also available on findings of Nemestrinidae in the Volga region (Becker, 1880; Zolotukhin et al., 1995; Narchuk, 2004). Four species are included into a key for insects of the European part of the USSR (Richter, 1969). The distribution of these species is wider than the territory covered by the key mentioned.

In Eastern Europe, nemestrinids are found locally and are rather rare. In spite of their large size and bright coloration, most of them were mentioned at the end of the 19th–beginning of the 20th century. Therefore, they should be treated as disappearing and endangered species. As far as it is known, no species of this group were included into Red Data Books for the territories discussed (Gorbatovskii, 2003). These large dipterans, buzzing above flowering plants, also possess esthetic importance similar to that of butterflies. The decrease in population density of Nemestrinidae in Eastern Europe is undoubtedly associated with the decrease in the population density of locusts, hosts of these parasitic dipterans. One of the goals of this publication is to attract attention of ecologists and specialists in nature protection to these insects.

I had at my disposal rather voluminous material on this family, deposited in the collections of the Zoological Institute RAS in St. Petersburg (hereinafter ZIN) and of the Institute of Zoology, Academy of Science of Ukraine in Kiev (hereinafter IZK). Materials from the collection of the Zoological Museum, Moscow State University, where collecting sites are mentioned, were published by Zimina (1985). Therefore, it seems interesting to give dotted range maps for some species. Together with the material from the above-mentioned museums, we took into account all the published data on distribution of these species. The species are rather easily distinguished; therefore, these data are reliable. Findings of these flies in northern and eastern regions of Russia and adjacent countries are the most interesting.

Subfamily NEMESTRINIDAE

Nemestrinus Latreille is one of the species-rich genera of the family; it includes 66 Palearctic species (Bernardi, 1973).

Nemestrinus bombiformis (Portschinsky, 1892)

The species was described as a single specimen from the slopes of Mt. Elbrus at a height of about 3000 m above sea level, collected at the end of the 19th century. The holotype (♂) is deposited in the collection of ZIN. In this collection the following specimens are also present: 1 ♀ from Kislovodsk (Portschinsky's coll.) and 2 ♂ from Armenia, Arich Artik, 17.VIII.1956 (Richter). The species is easily distinguished by its rather lengthy pubescent three-colored abdomen; white, black, and reddish-yellow hairs are situated at the base, middle, and apex of ab-

domen, respectively. The species is the endemic of the Caucasus.

Nemestrinus caucasicus (Fischer, 1806)

This is the most common species of Nemestrinidae in the fauna of Russia. The author had an opportunity to collect this species in Volga region in June 2003 in Bogdinskii-Boskunchakskii Nature Reserve (Astrakhan Province), in Eltonskii National Park (Volgograd Province), and in the southern Saratov Province. Flies were actively feeding on the flowering sage *Salvia tesquicola*, on sunny days hovering above flowers with characteristic buzzing. According to the data from the labels, in different years emergence of this species lasted from the end of May till the beginning of August; the majority of findings were made in June–early July. The species is easily recognized because of its black shining body coloration with white pubescence; the latter forms transverse strips on the abdomen. The frons and the face are black and matte; the face bears shining lateral strips. In both sexes, the ultimate abdominal segments are densely covered with reddish pollination; the species is easily distinguished by this character. In males, the frons is rather narrow, in median part not wider than the distance between the posterior ocelli; the eyes are formed by large and small facets, situated in the dorsal and ventral parts, respectively, the border between these parts of the eye is very distinct. Copulating pairs sit in the grass or fly lowly above vegetation. The male and the female are situated in the linear position with the female anteriorly; their heads are directed in the opposite directions.

The species was described from the Caucasus without mentioning of more detailed locality.

In the west of the range in Romania, the northern border passes slightly northwards to 44°N, and in the east of Europe, in the Volga Area, where the climate is more continental, it shifts northwards as far as 52°30'N. The northernmost findings in Russia include the south of Ulyanovsk Province (Zolotukhin et al., 1995); Voronezh Reserve; Guberli near Orsk, Orenburg Province (collection of ZIN); Troitsk, Chelyabinsk Province. The southernmost finding: Iran, Fort Sine-Sefid sur la route de Chiraz a' Kazer-oum (Bequaert, 1938), approximately 29°N. Localization of western and eastern borders is not clear. On the basis of the material from a museum in Vienna, Lichtwardt (1909) mentions Gabes (Tunisia). Paramonov (1951) also mentions northern Africa, but gives no material from northern Africa in the publication mentioned.

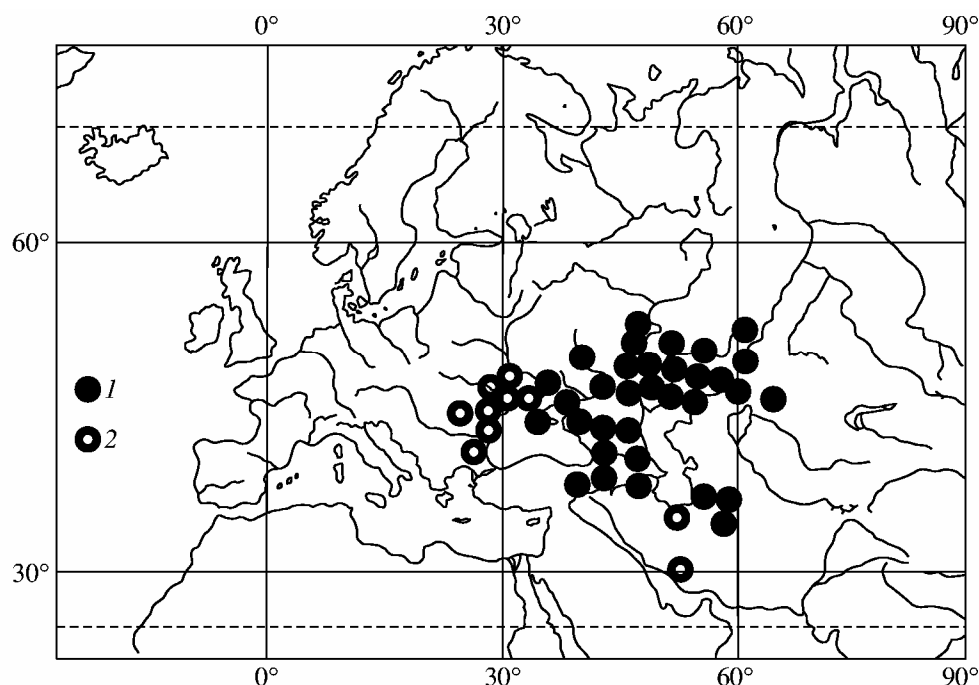


Fig. 1. Distribution of *Nemestrinus caucasicus*: 1, material studied; 2, literary data.

According to Bequaert (1938), the data on findings from Tunisia (Gabes) and Egypt are based on erroneous species identification, and corresponding material belongs to *N. fasciatus* (Olivier). Paramonov (1951) mentions Adjikent (Turkistan) as the easternmost collecting site. He mentions the material from the collection of ZIN. I saw this material, including a specimen from Adjikent. Adjikent is situated in Transcaucasia, in Azerbaijan, whereas Paramonov erroneously pointed to Turkistan. According to the material from the collection of ZIN, Bolshie Barsuki near Chelkar (Kazakhstan) is the easternmost collecting site. In Turkmenistan, this species was found in western Kopet Dag, Mt. Syunt. The species is mentioned for Turkmenistan for the first time.

The species is distributed in the following countries: Bulgaria, Romania, Ukraine, Russia, Georgia, Armenia, Azerbaijan, Turkey, Kazakhstan, Turkmenia, and Iran. Stackelberg (1950) calls this species "a single representative of the originally subtropical family of large long-proboscis Nemestrinidae that penetrated to steppes from deserts" (p. 173). The range of this species is shown in Fig. 1. It can be characterized as a Black Sea-western Kazakhstan-Iranian-Turanian range.

***Nemestrinus brandti* Bequaert, 1938**

The species was described from Iraq. Paramonov (1945) and Richter (1988) also point it to Azerbaijan.

In the collection of ZIN, a single female is present labeled: Nakhichevan, Darasham, (39°00'N and 45°62'E), 30.V.1933 (A. Bogachev), with determination label by Paramonov "*Nemestrinus marginatus brandti*." Paramonov (1945) treats this species only as a subspecies of *N. marginatus* Loew; in the catalogue of Palaearctic Diptera, Richter (1988) mentions it as a separate species.

In the original description, Bequaert (1938), who had examined only males, compares this species with *N. pubescens* Lichtwardt and *N. lichtwardti* Bequaert and points to the fact that it differs from all other species of the subgenus *Nemestrinus* s. str. by a matte pollinated (even laterally) face. I studied the same female that was examined by Paramonov. By contrast to *N. lichtwardti*, it possesses a pollinated face and, in contrast to females of *N. lichtwardti* and *N. marginatus*, a shorter spine-shaped outgrowth on cerci. It gives us all reason to treat *N. brandti* as a separate species. The pubescence of the frons is not black, as it was mentioned by Paramonov (1945), but brown. It has a Caucasian-Iranian range.

***Nemestrinus laetus obscuripennis*
(Portschinsky, 1887)**

N. laetus (Loew, 1873) was described from Iran (Astrabad). Zimina (1985) mentions this species from the following localities: Dzhervezh near Erevan and

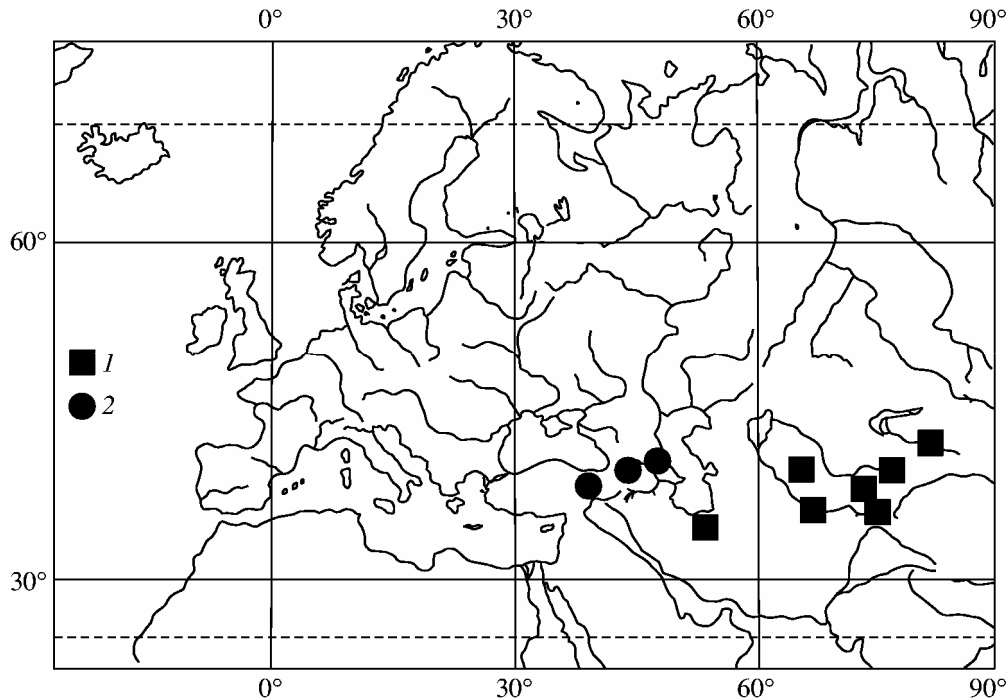


Fig. 2. Distribution of *Nemestrinus laetus laetus* (1) and *N. l. obscuripennis* (2).

Vedi (Armenia); Iliisk (Kazakhstan); Kushka (Turkmenistan); Pyandzhikent and Kurgan-Tyube (Tajikistan). In the collection of ZIN, the following material from Uzbekistan is present: Ferghana (Assake), Ferghana Mt. Range (Yangi Arab); Changyr near Khatyrchi to the northwest of Bukhara and Iran (collections of Zarudnyi); Akhangerun-Charakhs Zirukh Khorasan (det. Lichtwardt) and Arabistan, environs of Sherger. It is a large species (15–18 mm) with the brown-red abdomen and black spots on tergites along the median line. Wings are slightly darkened at basal two thirds. In females, frons, antennae, and legs, are all yellow. Female cerci have no hooked prominence. It has the eastern Mediterranean range (Fig. 2).

N. obscuripennis (Portschinsky, 1887) was described from Turkey (Surmali, to the northwest of Indgir) and treated as a synonym of *N. laetus* (Sack, 1933) or as a separate species (Richter, 1988). In the collection of ZIN, there are: the lectotype (male, designated by Richter and Kandybina, 1983) and five paralectotypes, and also 4 specimens from Armenia (Erevan). In comparison with Iranian and Middle Asian specimens, all the specimens from Armenia and Turkey are characterized by the presence of wider and more intense darkening of the median part of the fore wing and brighter red coloration of the abdomen. In the male genitalia, no significant differences from Iranian specimens were found. Taking into account

differences in coloration and the isolated character of distribution, *N. obscuripennis* should be treated as the Caucasian-Anatolian subspecies of *N. laetus* (Loew, 1873).

Nemestrinus reticulatus Latreille, 1802

The species was described from Egypt, Syria, and Lebanon. It is widespread from Greece to the Arabian Peninsula (including Turkey, Palestine, and Syria) and northern Africa (Egypt) (Bequaert, 1938; Bowden, 1985). In Transcaucasia, the species is known from Armenia (Dzhervezh, Echmiadzin, and Arni near Arazdayan) and Azerbaijan (Karaagachly). In the collection of ZIN, there is 1 specimen from Greece and 1 specimen from Turkey (Surmali). The latest findings were made in 1959.

Characteristically colored yellow palpi possess black apices. Wings are slightly infuscate at the base. The abdomen is gray, matte; tergite II bears shining black spots divided in the middle by a transverse longitudinal gray strip; black spots on tergites III–V are more or less fused into bands with an emargination along the posterior margin. In tergite III, gray emargination varies from very deep to nearly absent. In females, legs are yellow, only hind tarsi are blackish or entire hind legs are blackish. In males, all the femora are black; hind tibiae and tarsi are blackish. In females, cerci bear a rather long spine pointed dorsally.

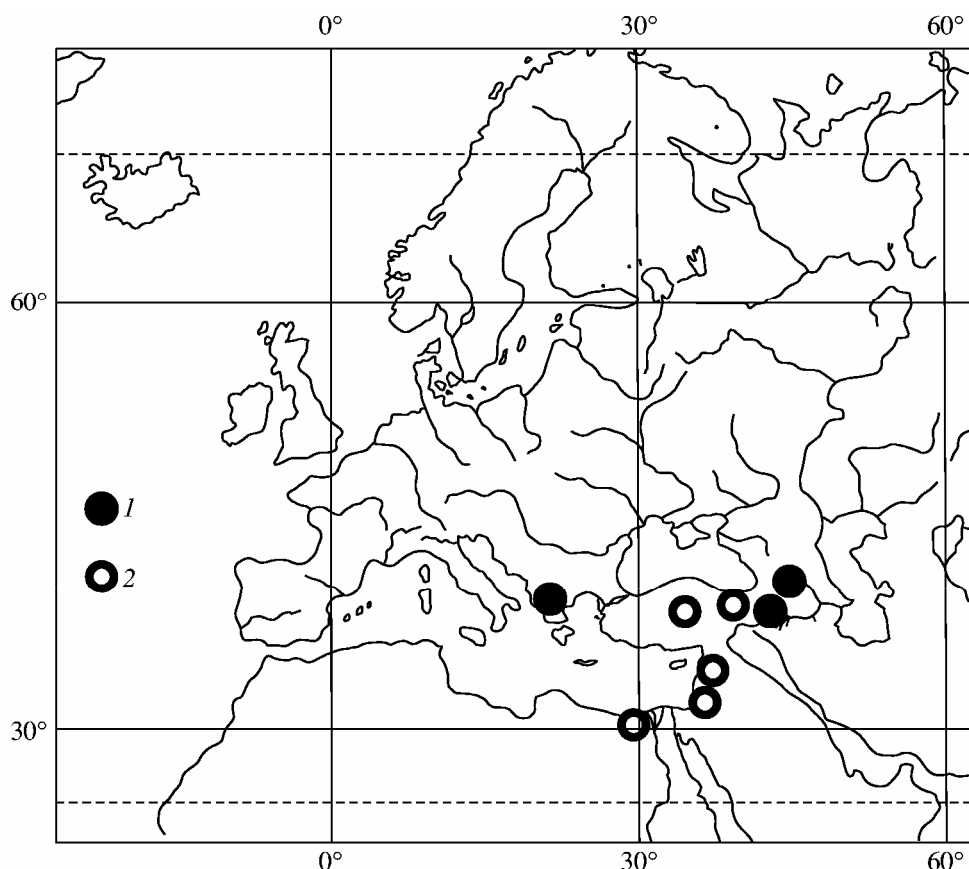


Fig. 3. Distribution of *Nemestrinus reticulatus*. For designations, see Fig. 1.

The range can be characterized as the eastern Mediterranean one (Fig. 3).

Subfamily TRICHOPSIDEINAE

Fallenia fasciata (Fabricius, 1805)

The species was described from Italy. It is found in the south of Eastern Europe, in the Crimea, Ukraine, and Dagestan (Russia). The species is mentioned for Russia for the first time. Two species of this genus are known from the Palaearctic; the second of these species, *F. semenovi* Paramonov, was recorded only from Iran. *F. fasciata* can be easily distinguished from other European and Caucasian species by the short face and wing venation with a characteristic triangular cell, which can be absent on one of the wings. Besides, females possess very long saber-shaped cerci. In Eastern Europe, this species can be included into a list of disappearing species; the finding in Dagestan was made in 1942, and since that time no specimens of this species were ever collected. However, I collected a series in western Kopet Dagh (Turkmenia) in 1979. Together with the abovementioned material, the collection of ZIN possesses some material from Azerbai-

jan (Margushevan near Terter, Arab-Mekhtabek), Morocco, Sicily, Spain, and Iran (Astrabad). The species is also known from France, Italy, Greece, Austria (environs of Vienna), and Croatia. Further eastwards, the species was recorded from Armenia, Azerbaijan, Turkey, Israel, Turkmenistan, and northern Iraq. In northern Africa, it was also found in Tunisia and Algeria. The range is shown in Fig. 5. It can be characterized as a widely Mediterranean range.

Neorhynchocephalus tauscheri (Fischer, 1812)

The species was described from Sarepta (at present, environs of Volgograd). It is a solitary species of the genus known from the Palaearctic; other species are spread in North (two species) and South (three species) America. It distinctly differs from other Palaearctic nemestrinids in the presence of a short diagonal vein not reaching the wing margin, the short and flat face, and the dense yellowish pubescence, which is arranged in strips along the posterior margin of tergites of the wide black abdomen. Variations in wing venation were noted by many authors and studied especially (Timon-David and Léonide, 1968). These

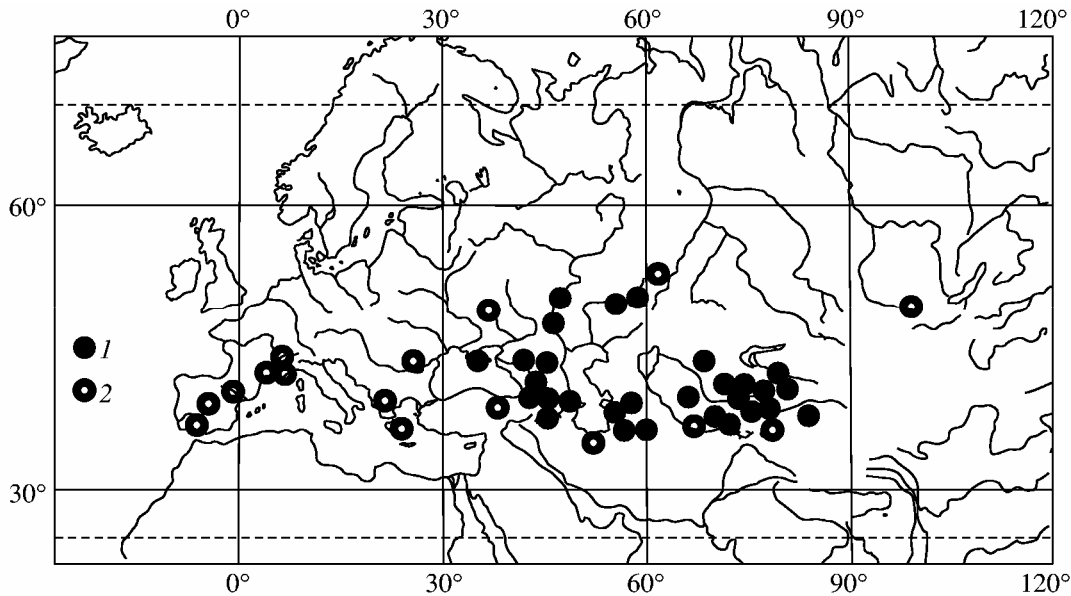


Fig. 4. Distribution of *Neorhynchocephalus tauscheri*. For designations, see Fig. 1.

authors noted 3 variants of arrangement of veins M_1 and M_2 . Both these veins independently reach the wing margin, fusing there without formation of a stem or form a stem-shaped cell. In European Russia and in Eastern Europe, this species is rare and can be treated as a disappearing species. The latest known findings were made in the 1920s: 1928 (Crimea, Ukraine) and 1927 (Kizlyar, Dagestan, Russia). Two maps of the distribution of this species were published (Paramonov, 1944; Bernardi, 1974); both maps are very schematic, without marked collecting sites. The borders of the range are drawn presumably and maps significantly differ. According to my data, the northernmost finding in Eastern Europe was made in Saratov (three specimens from the collection of E.A. Eversmann, the first half of the 19th century). The material from Ukraine (Crimea), southern Russia (Pyatigorsk, Kizlyar, Rostov-on-Don), and all the Transcaucasian states (Georgia, Armenia, Azerbaijan) is also known. The species is mentioned for Georgia for the first time. In the west of the range, the species is more common; in France, it was recorded from several southern departments and its larvae were found in the abdomen of an orthopteran of the genus *Platyolais* (Foucart and Males, 1989). In the eastern part of the range, the species is also rather common; it was found in Turkmenistan, Uzbekistan, Kirghizia, Tajikistan, Kazakhstan, Turkey, and Iran. The northernmost collecting site in Kazakhstan is Kokshetau (Kazakhstan small hills area), and the easternmost one, the Tashtyp River, tributary of Abakan, Khakassia Autonomous Territory,

Krasnoyarsk Territory. The range of the species according to collection and literary data (Lichtwardt, 1909; Paramonov, 1944; Timon-David and Léonide, 1968; Bernardi, 1974; Zimina, 1985) is shown in Fig. 4. It can be characterized as the northern Mediterranean-western Scythian-Turanian range.

The specimen from Krasnoyarsk Territory (Teshtyp River, S of Krasnoyarsk), mentioned by Paramonov (1944) and Richter (1988), was not found in the ZIN collection. The same is true for two other specimens with northernmost collecting sites: Provalskaya steppe (modern Lugansk Province, Ukraine) and Novinskii (environs of Troitsk; modern Chelyabinsk Prov. of Russia). Probably, these specimens were taken by Paramonov. *N. lativentris* Portschinsky, 1887, described as a single specimen from Astrabad (Iran), was synonymized to this species. Unfortunately, no type specimens were found in the collection of ZIN; it is also not mentioned in the catalogue of types of the collection of ZIN (Richter and Kandybina, 1983).

***Trichopsidea costata* (Loew, 1875)**
(= *Simmictus flavopilosus* Bigot, 1879)

The species was described from South Africa. It is distributed in southern Europe (France and Spain), Transcaucasia (Armenia) and in the entire Africa. In Armenia, the last findings were made in 1959. The biology of this species was studied in detail in southern France (Léonide, 1963, 1969) and in Ethiopia (Greathead, 1959).

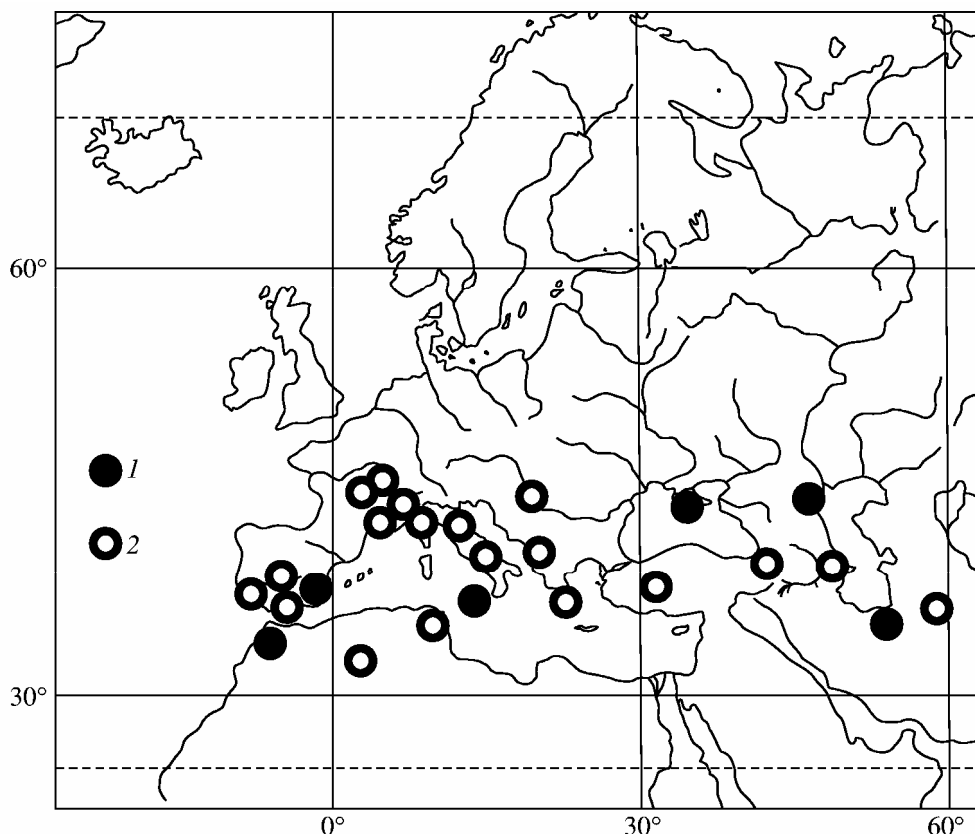


Fig. 5. Distribution of *Fallenia fasciata*. For designations, see Fig. 1.

Females lay eggs on old tree branches or dry stems of herbaceous plants, in crevices of roof tiles, and poles of building fences, mainly at the end of June. Oviposition lasts for several hours without intervals. Eggs are white-yellow, cylindrical, with rounded ends, 0.5 mm long and 0.17 mm in diameter. Eggs develop from 5 to 10 days at a temperature of 35°C and humidity 35 and 75%, respectively. At a temperature lower than 7°C, development stops. Emerged larvae of the planidium type with 6 setae on the posterior margin infest different Acrididae, including the Moroccan locust *Dociostaurus marrocanus* Thunb., *Calliptamus italicus* (L.), *Oedipoda coerulescens* (L.), *Oedaleus decorus* (Germ.) (Léonide, 1963), and *Schistocerca gregaria* (Forsk.) (Greathead, 1958). Usually larvae penetrate through joint membranes, mainly between mid coxae and femora, and leave their victim for pupation after eating off all its intestines.

A Key to Genera and Species of Nemestrinidae of Eastern Europe and the Caucasus

(*Nemestrinus reticuloides* Bowden, 1985, found in Turkey, is also included into the key, because its finding in Transcaucasia is very probable).

1. Proboscis long, noticeably longer than head 2.
- Proboscis reduced. Apical part of wing with 2 elongate triangular cells (Fig. 6, 1) *Trichopsidea* Westwood—1 species *T. costata* Loew.
2. Veins R_{3+4} and R_5 fusing in apical part, forming small triangular cell (in one of wings, this cell occasionally absent). Anal cell closed, with stem (Fig. 6, 2) *Fallenia* Meigen—1 species *F. fasciata* Fabricius.
- Veins R_{4+3} and R_5 not fused, triangular cell in apical part of wing absent. Anal cell opened or closed at the very wing margin, without stem (Fig. 6, 3–5) 3.
3. Diagonal vein does not reach wing margin. Apical wing margin without additional transverse veins (Fig. 6, 3). Face not projecting forward *Neorhynchocephalus* Lichtwardt—1 species *N. tauscheri* (Fischer).
- Diagonal vein reaches wing margin; apical part of wing occasionally with additional transverse veins, forming numerous cells (Fig. 6, 4–5) *Nemestrinus* Latreille ... 4.

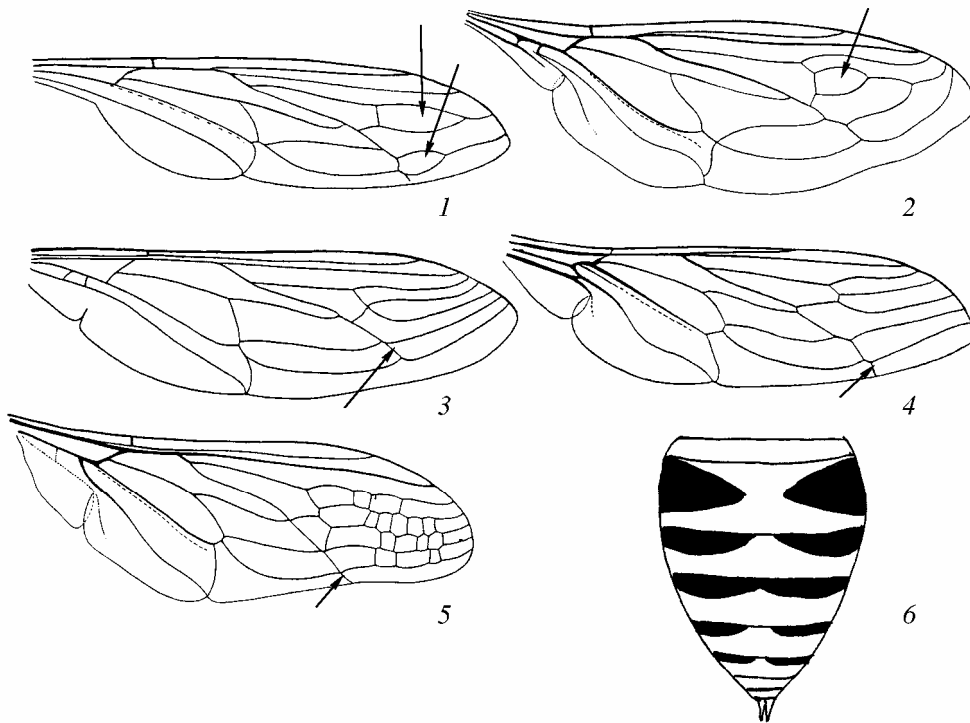


Fig. 6. Details of the structure of nemestrinids (according to Sack, 1933, and original data): (1) *Trichopsidea costata*; (2) *Fallenia fasciata*; (3) *Neorhynchocephalus tauscheri*; (4) *Nemestrinus caucasicus*; (5) *N. laetus obscuripennis*; (6) *N. reticulatus* [(1–5) wing; (6) abdomen]. Arrows indicate triangular cells and diagonal vein.

4. Wings with additional transverse abscissas, forming small cells in apical part of each wing (Fig. 6, 5) 5.

—Wings without additional transverse abscissas, and without net of small cells (Fig. 6, 4) 9.

5. Abdomen red-brown with longitudinal black strip in middle. Wings infusate in median part *N. laetus* Loew ... 6.

—Abdomen entirely gray, gray-brown, or with shining black spots. Wings can be slightly infusate at base 7.

6. Band on wings indistinct, brownish *N. laetus laetus* Loew.

—Band on wings distinct, black *N. laetus obscuripennis* Portschinsky.

7. Abdomen without shining spots. Face conical, matte. Hairs of occipital pubescence black or brown. Legs black. Posterior margins of tergites II–III with noticeable dark strips covered with small black hairs *N. brandti* Bequaert.

—Abdomen gray with shining black spots; spots widely separated on tergite III and fused anteriorly

on subsequent tergites; in posterior margins, this bands possess gray emargination (Fig. 6, 6) 8.

8. Frons with shining spot anteriorly to ocelli; spot triangular, transverse-rectangular or transverse-oval, yellow or black *N. reticulatus* Latreille.

—Frons matte without shining spots *N. reticuloides* Bowden.

9. Abdomen black, with transverse bands of white appressed hairs on tergites II–IV. Apex of abdomen in male and female with dense light brown pubescence *N. caucasicus* (Fischer).

—Abdomen with erect hairs, forming three subsequent bands: white, black, and reddish bands (from base) *N. bombiformis* Portschinsky.

Thus, the following eight species of nemestrinids occur in the Eastern European plain and the Caucasus: *Nemestrinus bombiformis* Portschinsky, *N. brandti* Bequaert, *N. caucasicus* (Fischer), *N. laetus obscuripennis* (Portschinsky), *N. reticulatus* Latreille, *Fallenia fasciata* (Fabricius), *Neorhynchocephalus tauscheri* (Fischer), and *Trichopsidea costata* (Loew).

Ranges of all the species, excluding the Caucasian endemic *N. bombiformis*, stretch beyond the borders of the region investigated.

Maps showing collecting sites are composed for ranges of five species: *Nemestrinus caucasicus*, *N. laetus*, *N. reticulatus*, *Neorhynchocephalus tauscheri*, and *Fallenia fasciata*; three of them were recorded in the Eastern European plain.

All the species, except for *N. caucasicus*, are very rare in the region studied; their findings were made at the end or in the first third of the 19th century or, less frequently, in the first half of the 20th century. They should be treated as disappearing species in the territory concerned. It is recommended to include them into lists of protected species and into the Red Data Books of the corresponding regions.

ACKNOWLEDGMENTS

The author is grateful to A.F. Emeljanov (ZIN) for consultations on the range nomenclature, and also to V.A. Richter (ZIN) for the data on the subspecies status of *Nemestrinus laetus obscuripennis* and for the deciphering of localities in the Caucasus.

The work was financially supported by the Russian Foundation for Basic Research (project no. 05-04-48258), the grant of the President of Russian Federation for the support of leading scientific schools (NSh 46.86.2006.4), programs of the Presidium of Russian Academy of Sciences "Biodiversity and Dynamics of Genepools" and "The Origin and Evolution of the Biosphere," and the Program of the Department of Biological Sciences of Russian Academy of Sciences "Fundamental Basis of Management of Biological Resources."

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