

**Immature stages of *Forcipomyia kaltenbachi* (WINNERTZ)
and *Forcipomyia nigrans* REMM (Diptera: Ceratopogonidae)**

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ABSTRACT. Larvae and pupae of *Forcipomyia* (*F.*) *kaltenbachi* (WINNERTZ) and *F.* (*F.*) *nigrans* REMM are described and illustrated for the first time. Identification keys to known larvae and pupae of the Polish species of the subgenus *Forcipomyia* are provided. Diagnoses of adults are included.

KEY WORDS: Diptera, Ceratopogonidae, *Forcipomyia*, larva, pupa, Poland.

Forcipomyia is a worldwide distributed genus, in Europe represented by 11 subgenera and almost 90 species (REMM 1988). Eight subgenera including 28 species are known to occur in Poland. A considerable part (13 species) belongs to the subgenus *Forcipomyia* (SZADZIEWSKI 1991). Preimaginal stages of the subgenus are relatively well known. In contrast to most Ceratopogonidae, whose early stages live in aquatic habitats, all larvae and pupae of *Forcipomyia* (*F.*) are typically terrestrial. Immature stages of 7 species known from Poland, have been described previously: *F. brevipennis* (MACQUART, 1826) - recorded from animal dung, *F. pulchrithorax* EDWARDS, 1924 - from open wounds of trees, *F. ciliata* (WINNERTZ, 1852) - from rotting fungi and touchwoods, *F. bipunctata* (L., 1767), *F. costata* (ZETTERSTEDT, 1838), *F. hygrophila* KIEFFER, 1925, *F. nigra* (WINNERTZ, 1852) - from rotting wood and bark, plant debris, mosses (SAUNDERS 1924, WIRTH 1970, WIRTH & GROGAN 1978, SZADZIEWSKI 1986). Larvae and pupae of *Forcipomyia* (*F.*) *kaltenbachi* (WINNERTZ, 1852) and *Forcipomyia* (*F.*) *nigrans* REMM, 1962 collected from rotting wood, bark and moss, are described here for the first time.

Most of specimens found were larvae (usually 4th instar). The rearing procedure followed SAUNDERS (1956). A better growth of larvae was observed at low illumination. Most of them were cleared in 10% KOH and mounted on slides according to the method described by WIRTH & MARSTON (1968).

In the paper I adopt special morphological terminology and abbreviations introduced by SAUNDERS (1924) for larvae. I propose here a nomenclature of processes and setae for pupae of *Forcipomyia* - like that proposed for *Atrichopogon* KIEFF. (SZADZIEWSKI et al. 1995). Keys are compiled from SAUNDERS (1924), WIRTH (1970) as well as my unpublished descriptions.

Forcipomyia kaltenbachi (Winnertz, 1852)

Figs. 1-9, 16-18

Ceratopogon kaltenbachii WINNERTZ, 1852: 19 (♂, ♀, Krefeld, Germany); CZWALINA 1893: 4 (record from Poland).
Forcipomyia kaltenbachi: REMM 1962: 170 (key, fig. male genitalia, Estonia, Russia - Moskovskaja obl.).

Diagnosis

Larva: setae b and d placed on very long, slender tubercle covered with dense spines. **Pupa:** 1st abdominal segment with fine processes only; abdominal segments 2-5 with 1 pair of long dorsal processes lacking setae, 6th abdominal segment without processes; thoracic horn with 8 openings. **Adults:** TR(III) about 0.6; third palpal segment of female with very deep sensory pit (Fig. 17); parameres in male genitalia H-shaped (Fig. 18 c).

Description

Larva (4th instar) (Figs. 1-2, 4-7)

Total length 4.5-5.0 mm. Body pale brown to yellow brown. Head: antenna moderately long. Setae p and q similar, long and slightly serrated, with very short pointed tips. Seta t smooth (Fig. 7). Other setae smooth, moderately long, not modified. Thoracic and abdominal segments: prolegs bilobed on 2/3 total length; hooklets placed paracentrally (Fig. 4). Seta a pale, club-shaped, finely serrated. First body segment with short seta a directed orally. Setae a on segments 2-11 gradually increasing in length, directed caudally. Setae b and d placed on common, very long and slender tubercle; seta b pale, long, distinctly curved, slightly serrated, with blunt apex; seta d straight, serrated with pointed apex; seta d absent on segment 11. Seta c distinctly serrated, slightly curved, apex pointed (Fig. 6 a-d). Cuticle covered with distinct, dense, black spines (Figs. 1, 2). Anal segment (12): anal papillae bilobed; seta b almost straight, setae a and c of similar shape as on other segments; arrangement of all setae of 12th segment as in Fig. 5.

Pupa (Figs. 3, 8-9)

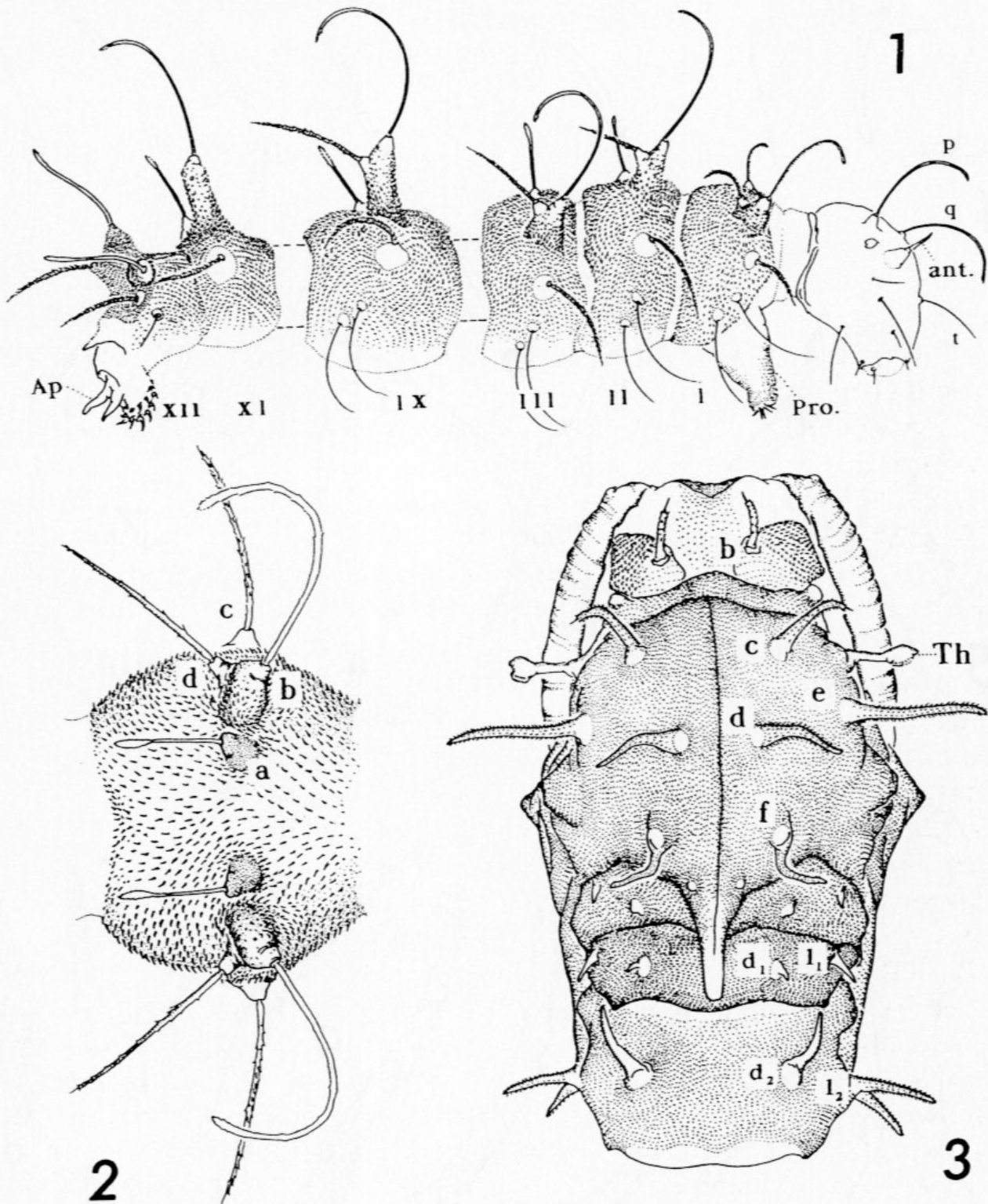
Total length 3.3-3.5 mm. Brownish yellow. Head: process a absent; process b relatively long with distinct seta (Fig. 9 b). Thorax: with 4 pairs of long stout densely serrated processes; process c with distinct seta only (Fig. 9 c-f). Thoracic horn moderately long; knob distinctly swollen with 8 openings; ThR 0.42 (Fig. 8). Thoracic prolongation reaching almost end of 1st abdominal segment (Fig. 3). Abdomen: 1st abdominal segment bearing 1 pair of dorsal (d_1) and 1 pair of lateral (l_1) fine processes (Fig. 9). Segments 2-5 with 1 pair of dorsal and 2 pairs of lateral stout, serrated processes without setae; lateral processes fused at their bases (Fig. 9 d_2 , l_2); 6th abdominal segment without processes.

Material examined

Sosnówka Dolna - Karkonosze, 10 Aug. 1982 - 1 ♀, leg. R. SZADZIEWSKI. Raciąż and Wysocki Młyn nr. Tuchola, 2 Apr. 1991 - 7 larvae, reared pupae, 2 ♂, 1 ♀; 7 July 1991 - 7 pupae, reared 3 ♂; 23 Sept. 1991 - 13 larvae; 5 Oct. 1991 - 60 larvae; 10-15 Sept. 1993 - c. 200 larvae, under rotting bark, branches, logs of *Pinus silvestris* and fine rotting twigs of unknown trees, and *Juniperus communis*, leg. W. GILKA.

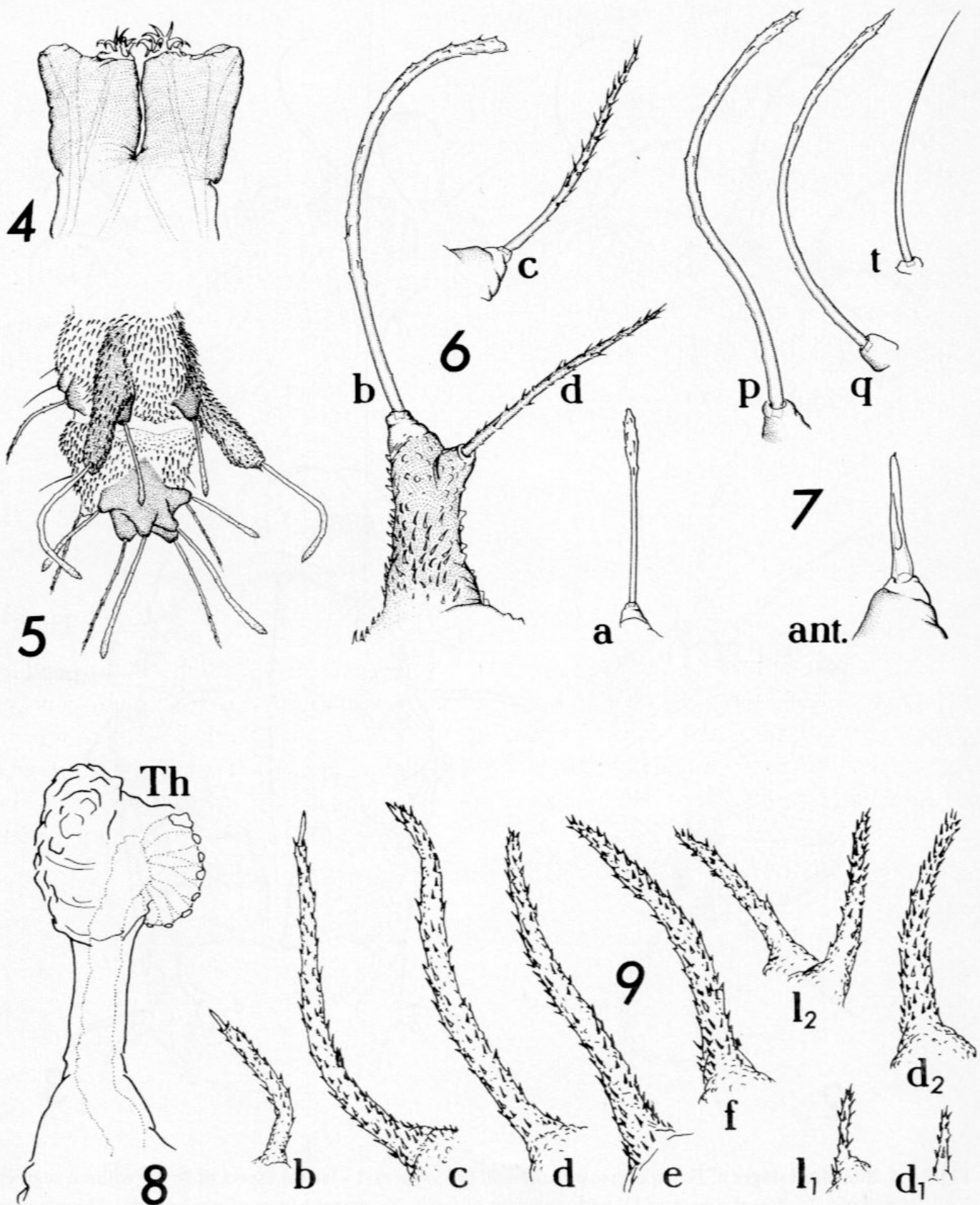
Distribution, biology

Palearctic species recorded from Germany, Poland, Estonia, Lithuania, Ukraine, Russia - northern part, Eastern Siberia and Far East (REMM 1988). From Poland recorded by CZWALINA (1893) in Gdańsk-Oliwa.



Figs. 1-3. Immature stages of *Forcipomyia kaltenbachi* (WINNERTZ). 1 - lateral aspect of larva (without segments IV-VIII and X), 2 - dorsal aspect of IX body segment of larva, 3 - dorsal aspect of pupa (part). Abbreviations. Larva: Ap - anal papillae, Pro - prolegs, ant. - antenna, p, q, t - setae of larval head, a-d setae of larval body. Pupa: Th - thoracic horn, b - head process, c-f - mesothoracic processes, d_n - dorsal process of n abdominal segment, l_n - lateral process of n abdominal segment.

Adults and pupae were reared from larvae and pupae collected in April and July only. Specimens collected in autumn created rearing problems - they never pupated and started to die after few weeks.



Figs. 4-9. Larva (4-7) and pupa (8-9) of *Forcipomyia kaltenbachi* (Winnertz). 4 - prolegs, 5 - preanal and anal segment, 6 - body setae, 7 - antenna and head setae, 8 - thoracic horn, 9 - processes of pupa.

It seems that this species is associated especially with *Pinus silvestris* although larvae, at the time they were found in abundance, appeared under fine twigs of other trees and even under rotting twigs of *Juniperus communis*. Numerous colonies were observed under rotting pieces of wood in old pine forests only (over 80 years), where the layer of moss was well developed. Larvae were found in pure colonies composed only of this species. *F. (F.) kaltenbachi* probably produces one generation per year.

Discussion

The species belongs to the *Forcipomyia costata* group including males with stout U or H-shaped parameres and females with very deep sensory pit on the 3rd palpomere. Distinct similarities between larvae of *F. kaltenbachi* and *F. costata* are expressed by the shape of the head and body setae (p, q and b, d). However, larvae of *F. kaltenbachi* are easy to distinguish by their characteristic, very long dorsolateral tubercles. Pupae of both species are similar in having distinctly and densely serrated processes.

This midge probably is not common in Poland (collecting adults with an entomological net or other methods was not effective).

Forcipomyia nigrans REMM, 1962

Figs. 10-15, 19-21

Forcipomyia nigrans REMM, 1962: 188 (♂, ♀, Estonia); WIRTH 1970: 337 (♂, ♀, Estonia), REMM 1988: 106 (Estonia, Lithuania, Germany, Russia - European northern territory, Far East, Eastern Siberia); SZADZIEWSKI 1991: 105 (record from Poland).

Diagnosis

Larva: cuticle smooth; head setae p and q lanceolate; body seta a lanceolate; prolegs bilobed on 1/3 total length; anal papillae bilobed. **Pupa:** head process b, thoracic process c and all processes of abdomen with very long setae; additional process of thorax c₁ present; thoracic horn with 6-7 openings. **Adults:** distal flagellomeres of female antenna short, ovoid (Fig. 19); third palpal segment of both sexes with poorly defined, shallow sensory pit (Fig. 20); male genitalia with characteristic broad parameres armed with teeth on ventral margin of enlarged apex (Fig. 21 c).

Description

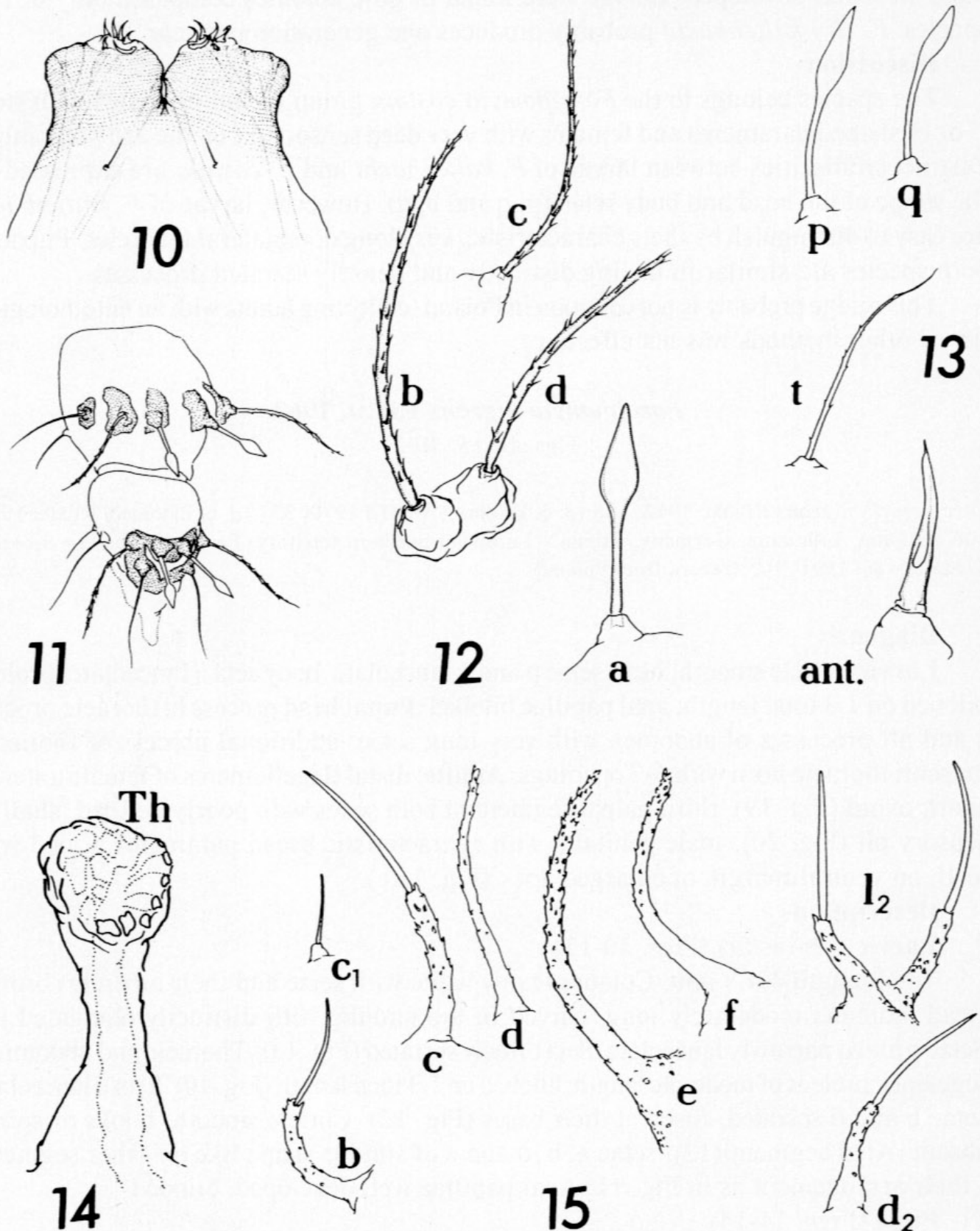
Larva (4th instar) (Figs. 10-13)

Total length 4-4.3 mm. Colour creamy white with setae and their tubercles brown. Head: antenna moderately long, curved in the middle, with distinctly elongated tip. Setae p and q narrowly lanceolate. Seta t finely serrated (Fig. 13). Thoracic and abdominal segments: prolegs of moderate length, bilobed on 1/3 total length (Fig. 10). Seta a lanceolate; setae b and d serrated, fused at their bases (Fig. 12). Cuticle smooth, hooks or spines absent. Anal segment (12): setae a, b, d and c of similar shape like on other segments - their arrangement as in Fig. 11. Anal papillae well developed, bilobed.

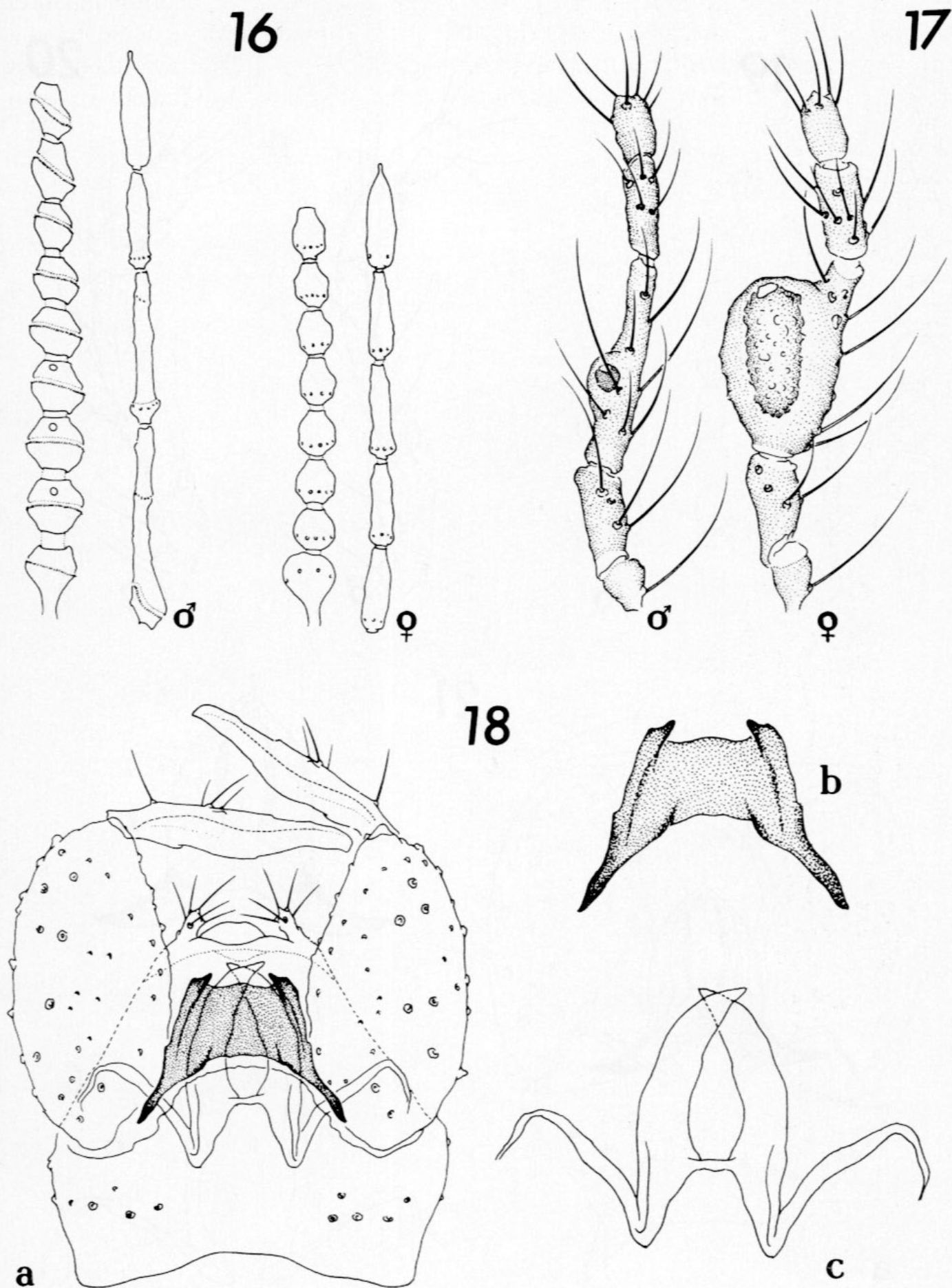
Pupa (Figs. 14-15)

Total length 3.0-3.2 mm. Exuvium pale yellow; poorly preserving after emergence of imago. Head: bearing pair of long lateral processes b with very long setae; pair of median processes a absent (Fig. 15 b). Thorax: with 4 pairs of moderately long, serrated

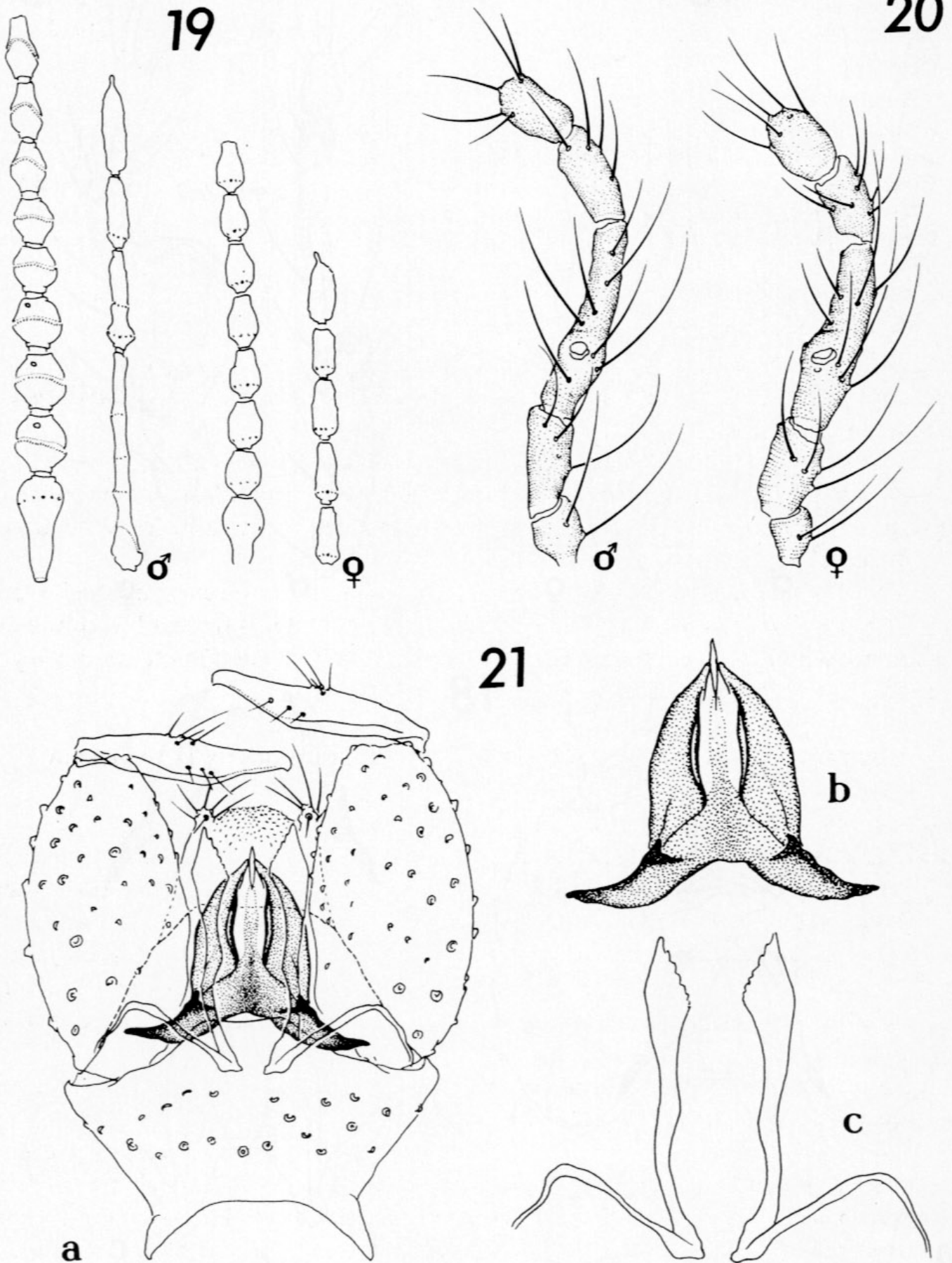
processes; process c with very long seta; processes d-f without setae; additional pair of thoracic processes c_1 with seta present (Fig. 15 c-f, c_1). Thoracic horn moderately long; knob slightly swollen; ThR 0.39; number of openings 6-7 (Fig. 14). Thoracic prolongation reaching middle of 1st abdominal segment. Abdomen: 1st abdominal segment with pair



Figs. 10-15. Larva (10-13) and pupa (14-15) of *Forcipomyia nigrans* REMM. 10 - prolegs, 11 - preanal and anal segment, 12 - body setae, 13 - antenna and head setae, 14 - thoracic horn, 15 - processes of the pupa (c_1 - additional process of mesothorax).



Figs. 16-18. Imago of *Forcipomyia kaltenbachi* (WINNERTZ). 16 - flagellum, 17 - palpus, 18 - male genitalia: a - ventral view, b - aedeagus, c - parameres.



Figs. 19-21. Imago of *Forcipomyia nigrans* REMM. 19 - flagellum, 20 - palpus, 21 - male genitalia: a - ventral view, b - aedeagus, c - parameres.

of dorsal and pair of lateral long processes bearing very long setae; segments 2-5 with 1 pair of dorsal and 2 pairs of lateral distinctly serrated processes - all with very long setae; lateral processes fused at their bases (Fig. 15 d₂, l₂); 6th abdominal segment without processes.

Material examined

Rubcowo nr. Augustów, Silec and Solanka nr. Kętrzyn, Pogorzelce nr. Białowieża and Białowiecki National Park, Ustrzyki Górne; 22 July 1977 - 12 ♂, 8 ♀; 8 June 1980 - ♂, ♀; 5 May 1981 - ♀; 15 August 1980 - ♀; 4-5 June 1981 - 2 ♀; 23-30 July 1980 - ♀, leg. R. SZADZIEWSKI. Raciąż nr. Tuchola and Wyskok nr. Kętrzyn, 20 June 1991 - 30 larvae, reared pupae, 8 ♂, 4 ♀; Sept. 1991 - 8 larvae; 5 Oct. 1991 - c. 50 larvae, reared pupae, 12 ♂, 5 ♀; 18 Oct. 1991 - 30 larvae; 5 Dec. 1991 - 25 larvae, under rotting bark of *Betula* and *Alnus*, under mosses covering a log of *Picea excelsa*, under twigs and fallen branches of *Pinus silvestris* and among mosses *Dicranum undulatum*, leg. W. GILKA.

Distribution, biology

This Palaearctic species is reported from Estonia, Poland, Germany, Lithuania, Russian northern part of Europe, East Siberia and Far East. Recorded from northern and eastern Poland by SZADZIEWSKI (1991).

Larvae of *F. (F.) nigrans* were observed in colonies together with larvae of *F. (F.) costata* and *F. (F.) pulchrithorax*. Pupae and adults were reared from larvae collected in June and October. The emergence of adults was observed usually after 7-10 days.

Discussion

There is such a great similarity between the larva of this species and the larva of *F. (F.) hygrophila* KIEFFER described by WIRTH (1970) that it was impossible to find any difference between these species. For this reason they are treated jointly in the key to larvae.

Key to larvae (4th instar) of Polish species of the subgenus *Forcipomyia*

- | | |
|---|--|
| 1. Body setae a lanceolate (Fig. 12) | 2 |
| - Body setae a of other shape (Fig. 6) | 6 |
| 2. Head setae p and q hair-shaped, serrated | <i>F. costata</i> (ZETTERSTEDT) |
| - Head setae p and q lanceolate, smooth (Fig. 13) | 3 |
| 3. Setae b and d on common tubercle (Fig. 12); cuticle smooth; apices of prolegs irregular (Fig. 10) | <i>F. nigrans</i> REMM, <i>F. hygrophila</i> KIEFFER |
| - Setae b and d on separated tubercles; cuticle with distinct spines; apices of prolegs rounded | 4 |
| 4. Prolegs deeply bilobed on 2/3 total length | <i>F. bipunctata</i> (L.) |
| - Prolegs shallowly bilobed on 1/4 total length | 5 |
| 5. Setae b and d distinctly curved, broom-like, with long dense serrations directed to one side. Body length up to 3.2 mm | <i>F. pulchrithorax</i> EDWARDS |
| - Setae b and d straight, with fine and sparse serrations directed to both sides. Body length up to 5 mm | <i>F. ciliata</i> (WINNERTZ) |
| 6. Anal papillae bilobed | <i>F. kaltenbachi</i> (WINNERTZ) |
| - Anal papillae single | 7 |
| 7. Body seta a very long, gradually tapering to tip | <i>F. nigra</i> (WINNERTZ) |
| - Body seta a short, swollen at middle, with distinct serrations | <i>F. brevipennis</i> (MACQUART) |

Key to pupae of Polish species of the subgenus *Forcipomyia*

1. Head with processes (Fig. 3) 4
- Head without processes 2
2. Thoracic horn with about 40 openings. Posterior prolongation of thorax short, reaching middle of 1st abdominal segment *F. ciliata* (WINNERTZ)
- Thoracic horn with less than 13 openings. Posterior prolongation of thorax long, reaching 2nd abdominal segment 3
3. Thorax with long and slender processes. Body length over 3 mm *F. bipunctata* (L.)
- Thorax with short processes or tubercles only. Body length less than or equal to 2.5 mm *F. pulchrithorax* EDWARDS
4. Abdominal segments 2-5 with 1 pair of dorsal processes (Fig. 3) 5
- Abdominal segments 2-5 with 2 pairs of dorsal processes 6
5. Dorsal process of 1st abdominal segment short without seta (Fig. 9d₁); dorsal processes of abdominal segments 2-5 without setae (Fig. 9d₂); thoracic process c with 1 short seta (Fig. 9c); additional process of thorax c₁ absent *F. kaltenbachi* (WINNERTZ)
- Dorsal process of 1st abdominal segment long with long seta; dorsal processes of abdominal segments 2-5 with long setae (Fig. 15d₂); thoracic process c with very long seta (Fig. 15c); additional process of thorax c₁ with seta present (Fig. 15c₁) *F. nigrans* REMM, *F. hygrophila* KIEFFER
6. Head with 2 pairs of long slender processes. Dorsal processes of abdominal segments fused at bases, 6th abdominal segment with processes *F. nigra* (WINNERTZ)
- Head with 1 pair of stout processes. Dorsal processes of abdominal segments separate, 6th abdominal segment smooth 7
7. Posterior prolongation of thorax short. 1st pair of dorsal processes of abdominal segments 2-5 four times longer than 2nd pair; additional process of thorax c₁ present *F. brevipennis* (MACQUART)
- Posterior prolongation of thorax long. 1st pair of dorsal processes of abdominal segments 2-5 two times longer than 2nd pair; additional process of thorax c₁ absent *F. costata* (ZETTERSTEDT)

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