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## THE GENITALIA OF THE DUTCH AGERIIDAE

by

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The Lepidopterous family Aegeriidae (Glass Wings) represents a compact natural group of species, easily recognisable by for the greater part hyaline wings (fig. 1). The group has been studied chiefly by F. le Cerf (1917) and G. F. Hampson (1892, 1919), and for North American species, by G. P. Engelhardt (1946). However, the genitalia received only moderate attention. Engelhardt figured those of the North American species, and Pierce & Metcalfe (1935), those of species occurring in the British Isles. Both these publications are not so easily available to the wider circle of Dutch lepidopterists; this may justify the publication of the present small iconography.

The Aegeriidae are moths of moderate size, flying rapidly in bright sunshine. The head is with appressed scales or rather rough. Ocelli are present. The antenna are usually thickened and spindle-shaped, tapering to a point, with a minute pencil of cilia at the tip. The proboscis is usually developed. The labial palpi are moderate, curved and ascending. The posterior tibiae are roughly scaled or haired (fig. 2).

The wings (fig. 1) are narrow, elongate, dilated and partly devoid of scales. Usually a discal mark (discoidal vein), costa, often also termen, are scaled; the disc of wing is variably scaled, with a longitudinal hyaline area. The hind wing is scaled only along the edge and along upper part of discoidal vein.

The fore wing has normally twelve veins, the hind wing eight veins, but vein 8 merges with the costal margin. Characteristic is a specialized locking mechanism between the fore and hind wings formed by the folded dorsal

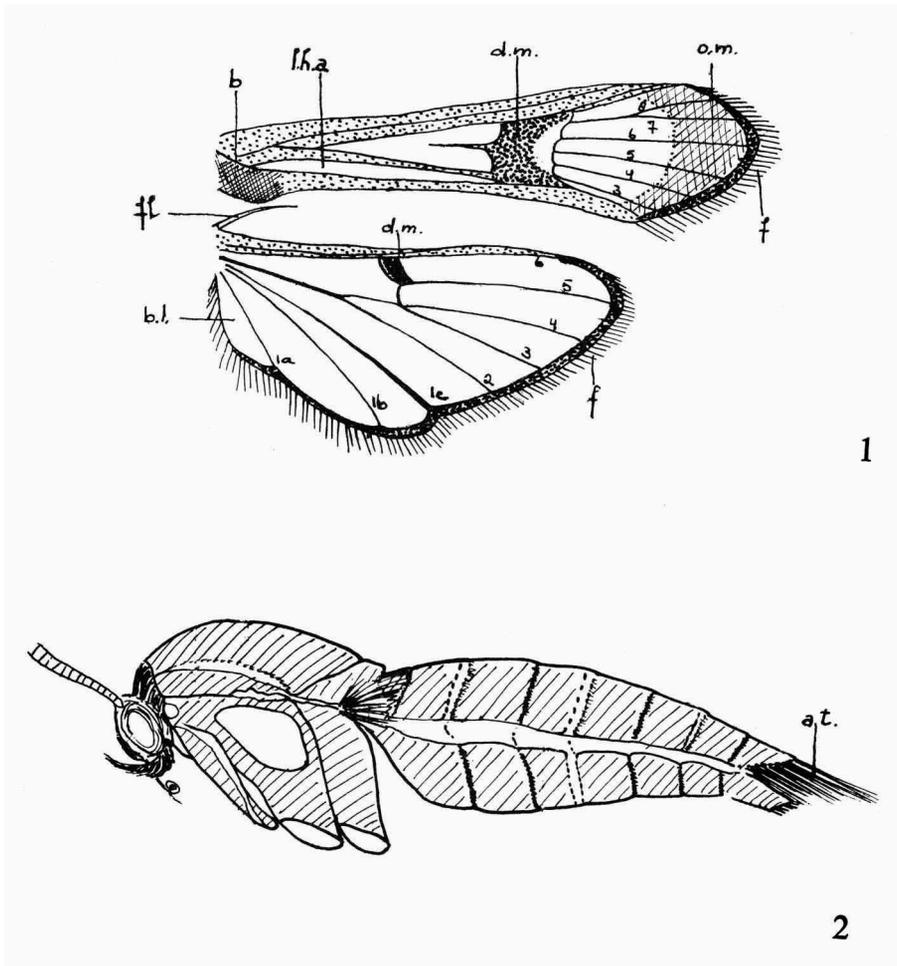


Fig. 1. Aegeriid wings. *b*, base of wings; *d.m.*, discal mark; *o.m.*, outer margin; *l.h.a.*, longitudinal hyaline area; *f*, fringe; *fl*, frenulum; *b.l.*, basal lobe. After Le Cerf.

Fig. 2. Aegeriid body. *a.t.*, anal tuft. After Le Cerf.

and costal margins, respectively, gripping into each other. A frenulum is also present. In Dutch Aegeriidae veins 7 and 8 in the fore wing are stalked. The course of veins 10 and 11 forms a discriminating character in the genera *Synanthedon*, *Chamaesphecia*, and *Dipsosphecia*, these veins running parallel, being fused or converging towards margin of wing, or closely approximated there, respectively (fig. 3-5). This feature is visible after removing the scales from the wing underside. In the hind wings veins 3 and 4 are stalked, except in *Aegeria apiformis* Cl. where they are connate.

I am grateful to Dr. A. Diakonoff, curator of Lepidoptera at this museum, for his suggestions and interest in this study, and to Dr. G. Kruseman Jr.,

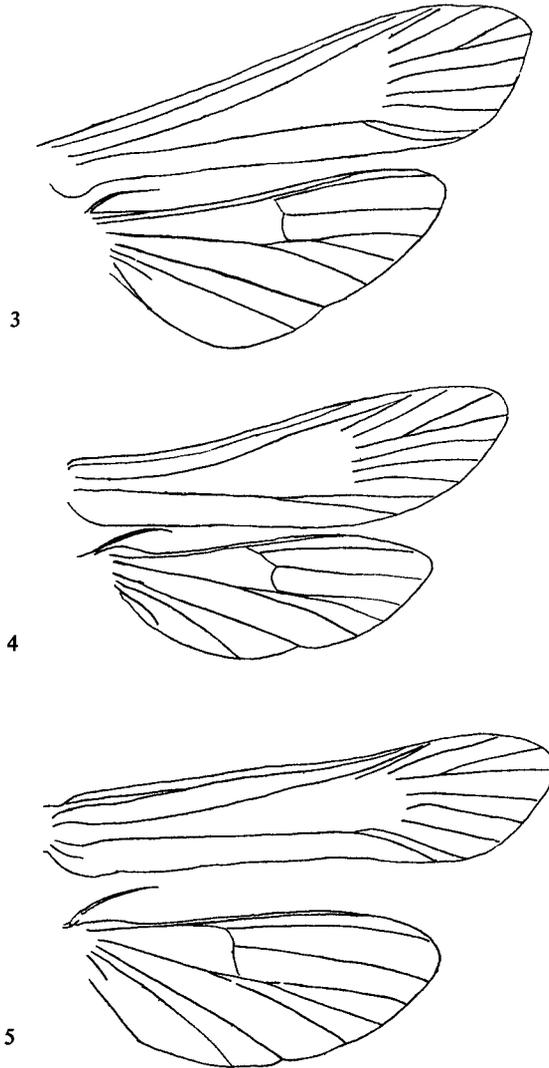


Fig. 3-5. Wing venation. 3, *Synanthedon tipuliformis* Cl.; 4, *Chamaesphecia empiformis* Esp.; 5, *Dipsosphecia ichneumoniformis* F.

Head Curator, Division of Insects, Zoologisch Museum, Amsterdam, for loan of material.

The following species of the Aegeriidae are known to occur in the Netherlands:

<i>Aegeria apiformis</i> Cl. (fig. 6-8)	<i>Synanthedon myopaeformis</i> Bkh.
<i>Sphacia crabroniformis</i> Lewin (fig. 9-11)	(fig. 25-27)
<i>Paranthrene tabaniformis</i> Rott.	<i>Synanthedon culiciformis</i> L. (fig. 28-30)
(fig. 12-14)	<i>Synanthedon formicaeformis</i> Esp.
<i>Bembecia hylaeiformis</i> Lasp. (fig. 15-17)	(fig. 31-33)
<i>Synanthedon spheciformis</i> Esp.	<i>Dipsosphacia ichneumoniformis</i> F.
(fig. 18, 20-21)	(fig. 34-36)
<i>Synanthedon tipuliformis</i> Cl. (fig. 19, 22)	<i>Chamaesphacia empiformis</i> Esp.
<i>Synanthedon vespiformis</i> L. (fig. 23-24)	(fig. 37-39)

Only the above mentioned species are considered here.

#### Key to the species of Dutch Aegeriidae based on external characters

1. Antenna ending in a minute tuft . . . . . 3
- Antenna not ending in a minute tuft . . . . . 2
2. Fore wing scaled throughout . . . . . *Paranthrene tabaniformis*
- Fore wing partially hyaline, devoid of scales in certain areas *Bembecia hylaeiformis*
3. Longitudinal hyaline area reduced or absent; veins 10 and 11 converging towards margin of wing . . . . . *Chamaesphacia empiformis*
- Longitudinal hyaline area clearly visible . . . . . 4
4. Fore wing hyaline save costa, which is densely scaled. Wingspan more than 3 cm 5
- Fore wing not entirely hyaline; besides costa and discal mark also the outer margin densely scaled. Wingspan less than 3 cm . . . . . 6
5. Thorax anteriorly with two yellow lateral patches on tegulae. Hind wing with veins 3 and 4 connate . . . . . *Aegeria apiformis*
- Thorax unicolorous, black. Collar yellow. Hind wing with veins 3 and 4 stalked . . . . . *Sphacia crabroniformis*
6. Posterior tarsus with first joint thickened by rough scales above. Fore wing with veins 10 and 11 well separated, parallel . . . . . *Synanthedon* species
- Posterior tarsus with first joint not thickened, smooth. Fore wing with veins 10 and 11 closely approximated without touching . . . . . *Dipsosphacia ichneumoniformis*

#### Key to the species of *Synanthedon*

1. Abdomen above with segmental edges yellow or white . . . . . 2
- Abdomen with segment 4 banded with red . . . . . 4
2. Antenna black, white or yellow towards tip above . . . . . *S. spheciformis*
- Antenna above unicolorous dark-brown . . . . . 3
3. Fore wing with discal mark black . . . . . *S. tipuliformis*
- Fore wing with discal mark orange at the outer side . . . . . *S. vespiformis*
4. Fore wing with outer margin leaden-reddish. Abdomen with segments 4, 5 and 6 red beneath. Thorax black . . . . . *S. formicaeformis*
- Fore wing with outer margin dark-brown. Abdomen with only segment 4 red beneath. Thorax beneath wing base laterally with orange patches . . . . . 5
5. Fore wing with base yellow-red. Labial palpus orange-red beneath *S. culiciformis*
- Fore wing with base not yellow-red. Labial palpus beneath black in females, and white at the inner side in males . . . . . *S. myopaeformis*

## GENITALIA

Genitalia of the Aegeriidae occurring in the Netherlands were dissected, mounted and figured. The characters of these genitalia in general, and those of the males in particular, are very significant for the identification of the species.

In the male genitalia the following parts may be distinguished. The uncus is short and divided at the apex in the genera *Aegeria*, *Sphacia* and *Bembecia*; in other genera the uncus is more elongated and less strongly divided, which is considered an advanced character (Engelhardt). In the genus *Synanthedon* as well as in *Dipsosphacia* the uncus is developed into apical backwards curved pads which are covered with characteristic forked hairs. The gnathos in the genus *Bembecia* is moderately large and has two strongly sclerotized papillae at the apex; in other genera it is developed normally. The annellus is usually small, save in the genus *Bembecia*, where it is fairly large. The aedeagus is usually long and becomes narrower towards the apex. At the apex small diverging structures, cornuti, are often visible. The vinculum has normally a short extending part, save in the genus *Dipsosphacia*, where it is long. In this article the vinculum is termed short or long, respectively, when the length of its extending part is smaller or larger than the breadth of the valva. The valvae are short and more or less quadrangular in the genera *Aegeria*, *Sphacia* and *Bembecia*; in the other genera they are more elongate and ovate. The valvae are covered with hairs, which are thin and soft or spiny, forked or not; these are important specific characters. The bifurcate hairs are similar to those on the uncus. The sacculus, at the basal side of the valva, is bordered costally by an oblique ridge of characteristic hairs, the sacculus ridge. In this paper the sacculus ridge is termed diagonal, when it runs slantwise from the middle of the ventral border close to the base of the valva.

## Key to the species based on male genitalia

- |  |                                      |
|--|--------------------------------------|
| 1. Uncus with bifurcate hairs . . . . .                            | 5                                    |
| — Uncus without bifurcate hairs . . . . .                          | 2                                    |
| 2. Uncus divided at apex . . . . .                                 | 3                                    |
| — Uncus not divided at apex . . . . .                              | <i>Chamaesphacia empiformis</i>      |
| 3. Valva short and quadrangular . . . . .                          | 4                                    |
| — Valva long and ovate . . . . .                                   | <i>Paranthrene tabaniformis</i>      |
| 4. Gnathos small; apex divided into two lobes . . . . .            | <i>Aegeria apiformis</i>             |
| — Gnathos small, without lobes at apex . . . . .                   | <i>Sphacia crabroniformis</i>        |
| — Gnathos large; apex with two sclerotized dark papillae . . . . . | <i>Bembecia hylaeiformis</i>         |
| 5. Vinculum short; gnathos large . . . . .                         | <i>Synanthedon</i> species           |
| — Vinculum long; gnathos small . . . . .                           | <i>Dipsosphacia ichneumoniformis</i> |

Key to *Synanthedon* species based on male genitalia

1. Aedeagus divided at apex . . . . . 2
- Aedeagus not divided at apex . . . . . 3
2. Sacculus ridge, about diagonal, covered with very small, not bifurcate hairs. Gnathos fairly round. Uncus straight . . . . . *S. myopaeformis*
- Sacculus ridge covered with long spines. Gnathos not round. Uncus curved backwards . . . . . *S. culiciformis*
3. Sacculus ridge diagonal . . . . . 4
- Sacculus ridge costally bordered with deeply bifurcate hairs . . . . . *S. vespiformis*
4. Gnathos moderately large and elongate. Sacculus ridge covered with dark, long spines; dorso-apically from this some separate spines . . . . . *S. spheciformis*
- Gnathos round and nearly double-cardiform. Sacculus ridge covered with very short spines . . . . . *S. formicaeformis*

In the female genitalia the following parts are of importance. The bursa copulatrix is bag-shaped, rounded or oblong. The presence of a signum is characteristic; in the genera *Bembecia*, *Synanthedon*, and *Dipsosphecia* it is absent. The ostium bursae, which is of great value for the identification, is entirely or partly sclerotized in the genera *Sphecia* and *Paranthrene*; in *Synanthedon vespiformis* L. it has rising folds on both sides and in *Synanthedon formicaeformis* Esp. it is enveloped by an mosaic-like structure. The neck of the ostium forms the upper part of the ductus bursae. The ductus bursae may be long and narrow (as in the genera *Synanthedon* and *Paranthrene*) or short and thick (as in the genera *Aegeria*, *Sphecia* and *Bembecia*); intermediate forms do also exist (e.g., *Dipsosphecia* and *Chamaesphecia*). The ductus bursae is termed short or long, when it is shorter or longer than the anapophyses. Likewise we call the ductus bursae narrow or broad, when its diameter is 1 to 1.5 times or at least 2 times as large as that of the anapophyses. The apophyses are simple in shape; here and there they have knotty widenings towards or at the end.

## Key to species based on female genitalia

1. Bursa with signum . . . . . 2
- Bursa without any signum . . . . . 5
2. Signum oblong or consisting of several dots . . . . . 3
- Signum consisting of one circular dot, surrounded by a few granulations . . . . . *Aegeria apiformis*
3. Signum oblong surrounded by granulation . . . . . 4
- Signum a straight longitudinal row of dots, which are thickened spots on the transverse wrinkles . . . . . *Paranthrene tabaniformis*
4. Signum oval. Ostium with a darkly sclerotized, collar-like margin, which is widening upwards . . . . . *Sphecia crabroniformis*
- Signum bar-shaped Ostium elongate, funnel-shaped; somewhat sclerotized . . . . . *Chamaesphecia empiformis*
5. Ductus bursae wide . . . . . 6

- Ductus bursae normally small (except in *Synanthedon vespiformis*) . . . . .  
*Synanthedon* species
6. Bursa oblong and pear-shaped. Ostium sclerotized, wide and cup shaped . . . . .  
*Bembecia hylaeiformis*
- Bursa about spheroidal, to its upper part both ductus bursae and ductus bullae are attached . . . . .  
*Dipsosphacia ichneumoniformis*

#### Key to species of *Synanthedon* based on female genitalia

1. Ostium sclerotized or enveloped by a mosaic-like structure . . . . . 2  
 — Ostium not sclerotized . . . . . 4
2. Anapophyses without knotty widenings . . . . . 3  
 — Anapophyses with knotty widenings just before the tips . . . . . *S. spheciformis*
3. Ostium funnel-shaped, at both sides enveloped by a mosaic-like structure, bordered by sclerotized folds, nearly converging at their upper parts . . . . . *S. formicaeformis*  
 — Ostium sclerotized and about triangular; at top of triangle a dark, sclerotized, U-shaped notch; neck of ostium sclerotized . . . . . *S. tipuliformis*
4. Ostium funnel-shaped or U-shaped. Ductus bursae without notch . . . . . 5  
 — Lower margin of ostium tubular. Ductus bursae with notch just below junction with ductus bullae . . . . . *S. vespiformis*
5. Ostium small and funnel-shaped . . . . . *S. culiciformis*  
 — Ostium U-shaped, deeply sunk between the lobi annales . . . . . *S. myopaeformis*

A classification based on female genitalia is not altogether satisfactory; the female genital apparatus is normally more simple than that in the male, so that the amount of characters which can be used for classification is limited. Some of these characters, however, are of importance, as, e.g., the ostium bursae and the degree of sclerotization.

Finally a short description of the general appearance of the male and female genitalia for each Dutch species may be presented.

#### **Aegeria apiformis** Cl. (fig. 6-8)

♂. Uncus divided at apex. Gnathos with apex divided into two heavily sclerotized lobes. Aedeagus straight and moderately broad; at apex cornuti spine-shaped. Valva short, truncate and quadrangular. Apex bluntly pointed with patches of heavy spines. Vinculum moderately short. Gen. no. 5602.

♀. Bursa oblong; signum minute and circular. Ostium not sclerotized; widened at the upper part. Ductus bursae short and broad. Apophyses truncate. Gen. nos. 5600 and 5601.

#### **Sphecia crabroniformis** Lewin (fig. 9-11)

♂. Uncus furcate. Gnathos with apex darker sclerotized, not divided. Aedeagus rather broad. Valva short and quadrangular; at apex long spines; in centre a sclerotized patch with thin hairs. Near base of valva a few spines. Vinculum with a broad and short process. Gen. nos. 5605 and 5606.

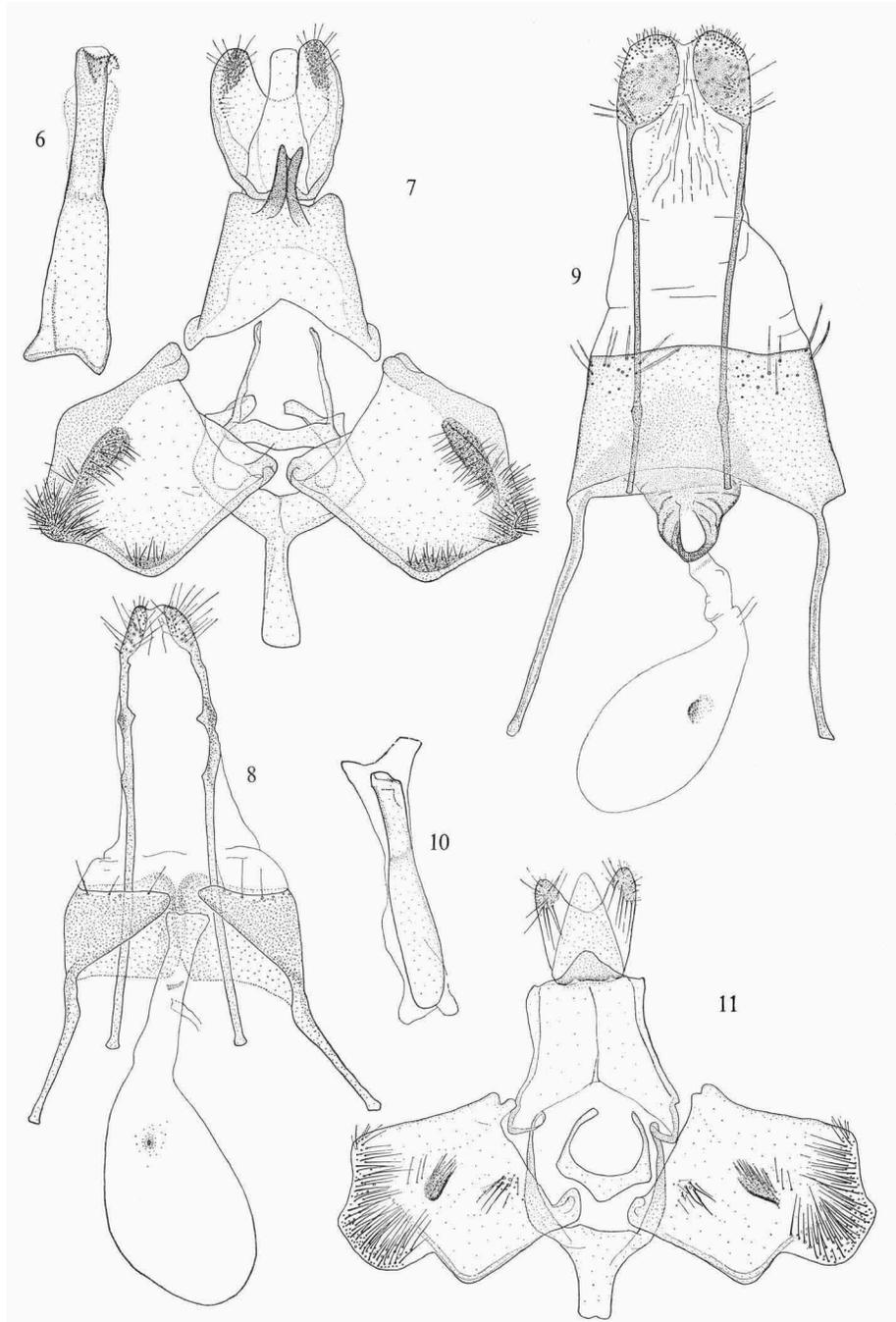


Fig. 6-11. Genitalia of Dutch Aegeriidae. 6-8, *Aegeria apiformis* Cl.: 6-7, male; 8, female. 9-11, *Sphacia crabroniformis* Lewin: 9, female; 10-11, male.

♀. Bursa pear-shaped; signum granulate and about ovate. Lower margin of ostium with a sclerotized collar-like fold, extending laterad of ostium. Ductus bursae short and broad. Apophyses truncate and hyaline at their tips. Gen. nos. 5603 and 5604.

**Paranthrene tabaniformis** Rott. (fig. 12-14)

♂. Uncus at apex divided into elongate, erect processes clothed with long, soft hairs. Aedeagus with bulbous base, slightly curved, with a down-pointed subapical hook. Valva elongate-ovate, edges with inwardly directed thin hairs and scales, leaving a naked area in middle; scales on costa trifurcate; cucullus clothed with a row of long single hairs, terminating in sacculus ridge, which is clothed with strong spines. Vinculum with a slender process. Gen. nos. 5608 and 5609.

♀. Bursa elongate-ovate, finely transversely wrinkled; signum a straight longitudinal row of dots, being thickened spots of transverse wrinkles. Ostium widely U-shaped, neck of ostium strongly sclerotized on edges. Ductus bursae narrow and very long. Anapophyses situated for a part near the lobi anales, the caudal tips bending over to each other. Gen. no. 5607.

**Bembecia hylaeiformis** Lasp. (fig. 15-17)

♂. Uncus divided into two short, hairy processes. Ventral plate of gnathos large and broad. Aedeagus stout and straight; apex with spine-shaped cornuti, below these three teeth. Valva short, rectangular with simple hairs, without specialized scales. Vinculum with a moderately long and broad process. Gen. no. 5612.

♀. Bursa elongate and bag-shaped, no signum. Ostium cup-shaped, sclerotized. Ductus bursae wide, with upper part strongly sclerotized. Apophyses sclerotized; postapophyses truncate and hyaline at tips. Gen. no. 5610.

**Synanthedon** Hübner

The general characters of this genus are as follows.

Uncus covered with bifurcate hairs; vinculum with a moderately short process; tegumen curved; gnathos moderately large and oblong; sacculus ridge with flat scales in a dense, obliquely curved series; aedeagus often with short, stout cornuti.

Bursa egg- or pear-shaped; no signum; ductus bursae long and narrow, except in *Synanthedon vespiformis* L.

**Synanthedon spheciformis** Esp. (fig. 18, 20-21)

♂. Uncus covered with bifurcate hairs. Gnathos moderately large and elongate. Aedeagus straight. Valva with terminally and costally bifurcate hairs;

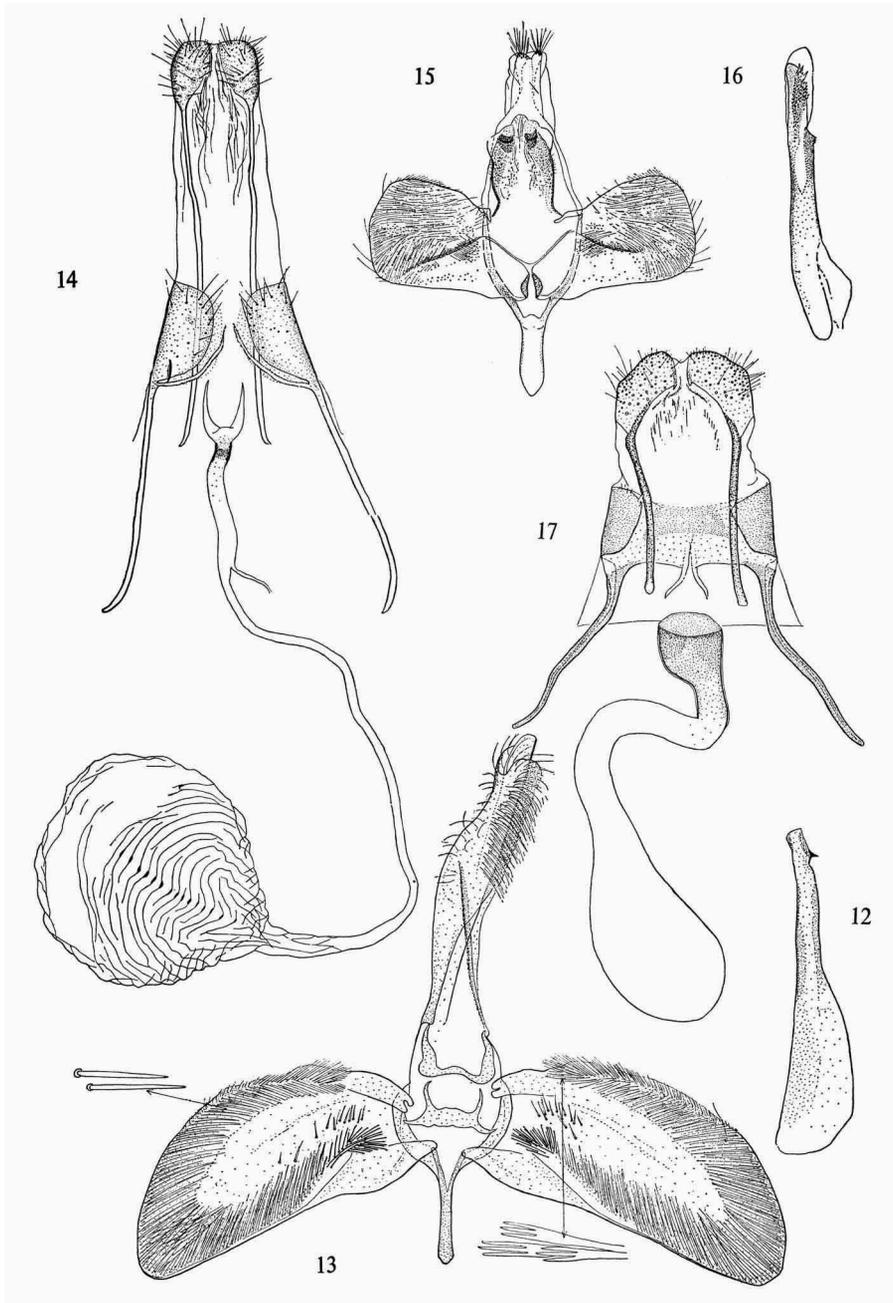


Fig. 12-17. Genitalia of Dutch Aegeriidae. 12-14, *Paranthrene tabaniformis* Rott.: 12-13, male; 14, female. 15-17, *Bembecia hylaeiformis* Lasp.: 15-16, male; 17, female.

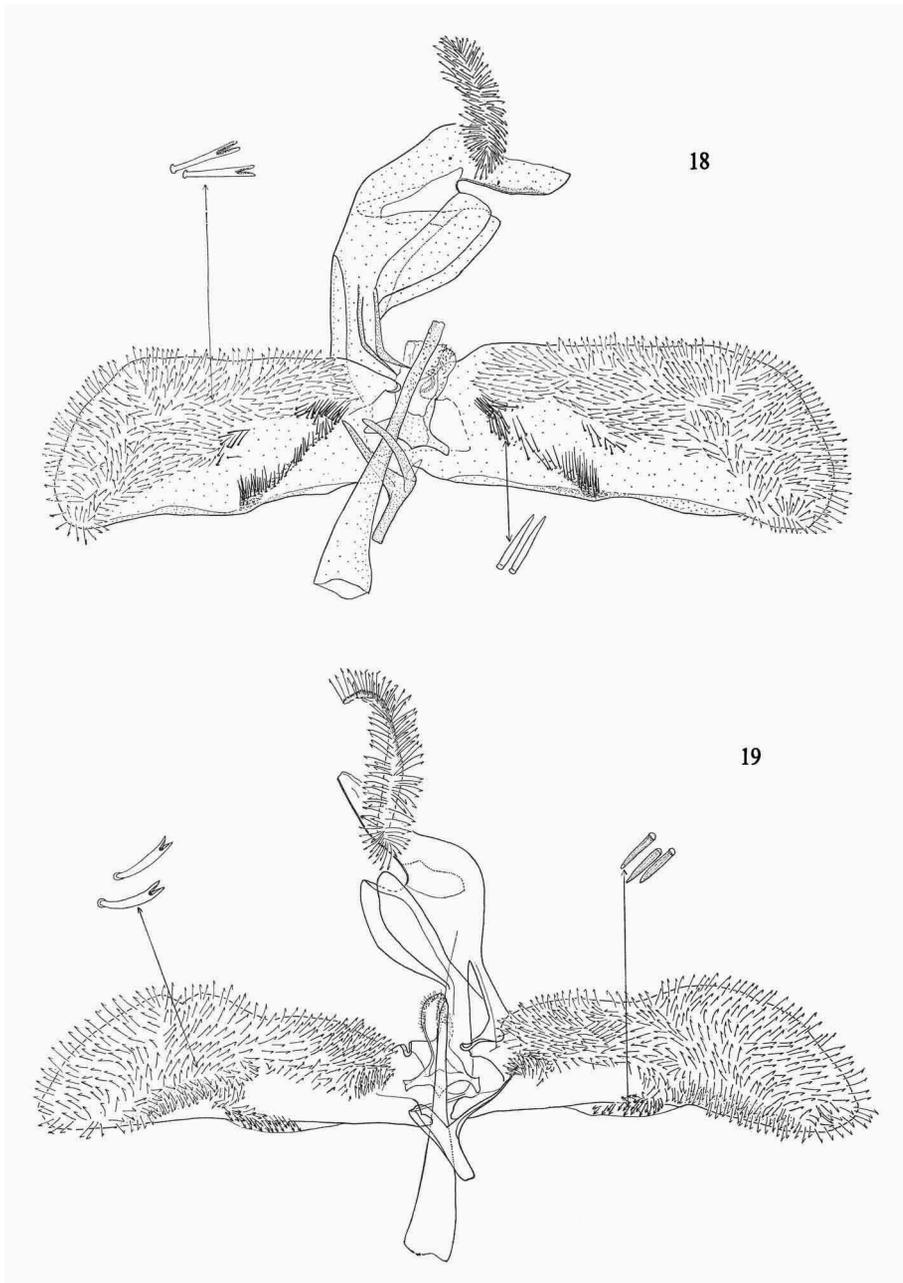


Fig. 18-19. Genitalia of Dutch Aegeriidae. 18, *Synanthedon spheciformis* Esp., male; 19, *S. tipuliformis* Cl., male.

apex blunt, truncate; sacculus ridge diagonal; in the middle of the valva a few spines. Vinculum with a short and narrow process. Gen. no. 5616.

♀. Bursa egg-shaped; no signum. Ostium sclerotized, funnel-shaped; at the bottom slightly constricted; the upper side of ostium recurving and dilated at both sides wing-like. Ductus bursae long and narrow. Anterior apophyses (anapophyses) knotty, widened just before tips. Gen. nos. 5615 and 5613.

**Synanthedon tipuliformis** Cl. (fig. 19 and 22)

♂. Uncus large, somewhat curved and covered with bifurcate hairs. Gnathos elongate. Aedeagus straight. Valva costally and terminally covered with bifurcate hairs; sacculus ridge at the ventral side of the valva, with moderately short spines. Vinculum with a short process. Gen. no. 5619.

♀. Bursa egg-shaped; no signum. Ostium triangular and sclerotized; at upper side a U-shaped notch, heavily sclerotized at the outside. Neck of ostium sclerotized. Ductus bursae long and narrow. Gen. no. 5618.

**Synanthedon vespiformis** L. (fig. 23-24)

♂. Uncus oblong, covered with bifurcate hairs. Aedeagus at apex with short spines; below these a few separate cornuti. Valva subovate; costally and terminally covered with bifurcate hairs. Sacculus ridge along costa, clothed with hairs, broad and stubby at their tips. The ventral hairs of sacculus ridge directed downwards; in the American form on the contrary these hairs are directed upwards (Engelhardt, 1946, pl. 6 fig. 35). Vinculum with a basal process dilated basad. Gen. no. 5625.

♀. Bursa drop-shaped; no signum. Ostium not sclerotized, tube-shaped; at the upper part rising folds of lobi anales. Ductus bursae wide and short; somewhat bent just below the juncture of ductus bullae. This bend is absent in American species (Engelhardt, 1946, pl. 13 fig. 65). Gen. nos. 5624 and 5623.

**Synanthedon myopaeformis** Bkh. (fig. 25-27)

♂. Uncus straight; covered with bifurcate hairs. Gnathos round. Aedeagus forked at apex into two unequal parts; apex sclerotized; base triangular. Valva elongate-ovate; costally and terminally covered with bifurcate hairs. Sacculus ridge diagonal; covered with short spines in a row. Vinculum with a short process. Gen. no. 5629.

♀. Bursa egg-shaped; no signum. Ostium not sclerotized, widely U-shaped; deeply set between lobi anales. Ductus bursae long and narrow. Posterior apophyses knotty at tips. Gen. no. 5627.

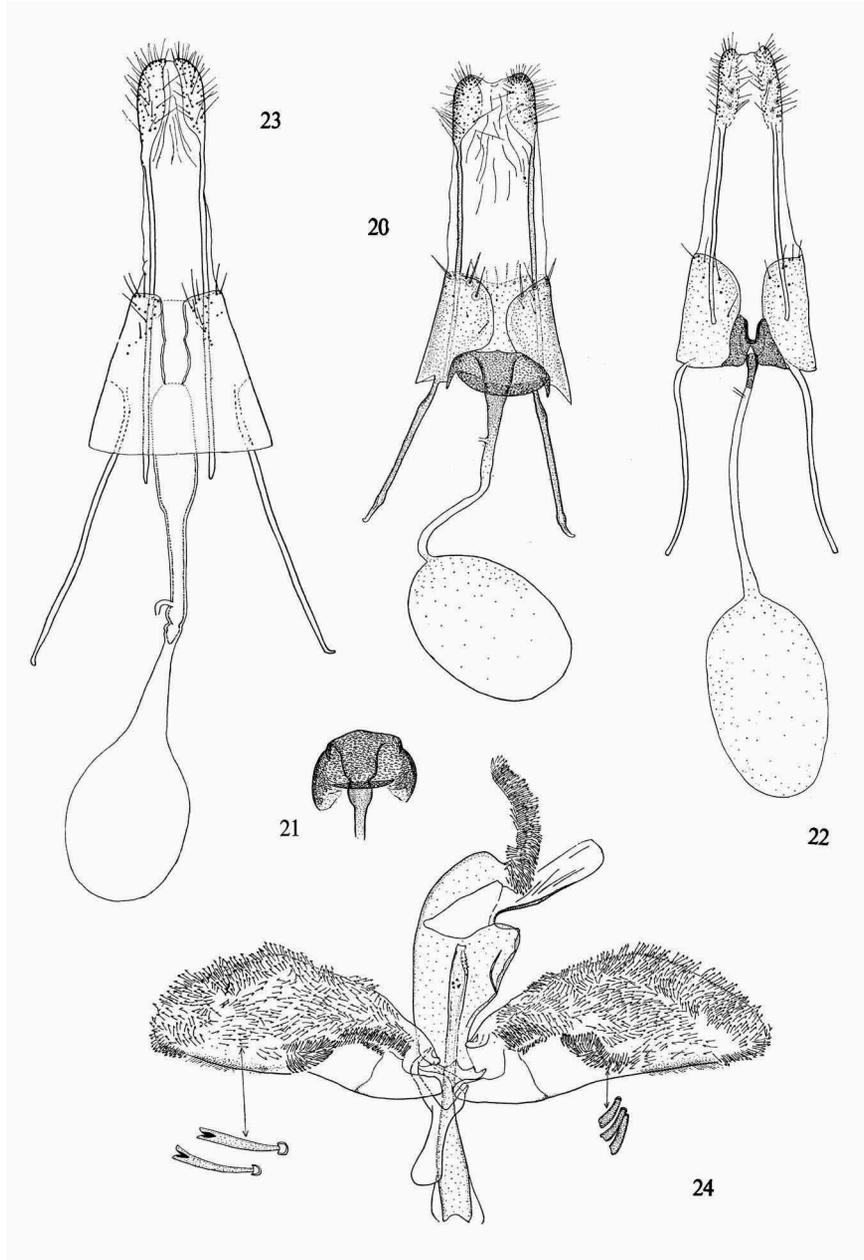


Fig. 20-24. Genitalia of Dutch Aegeriidae. 20-21, *Synanthedon spheciformis* Esp.: 20, female; 21, detail of ostium. 22, *S. tipuliformis* Cl., female. 23-24, *S. vespiformis* L.: 23, female; 24, male.

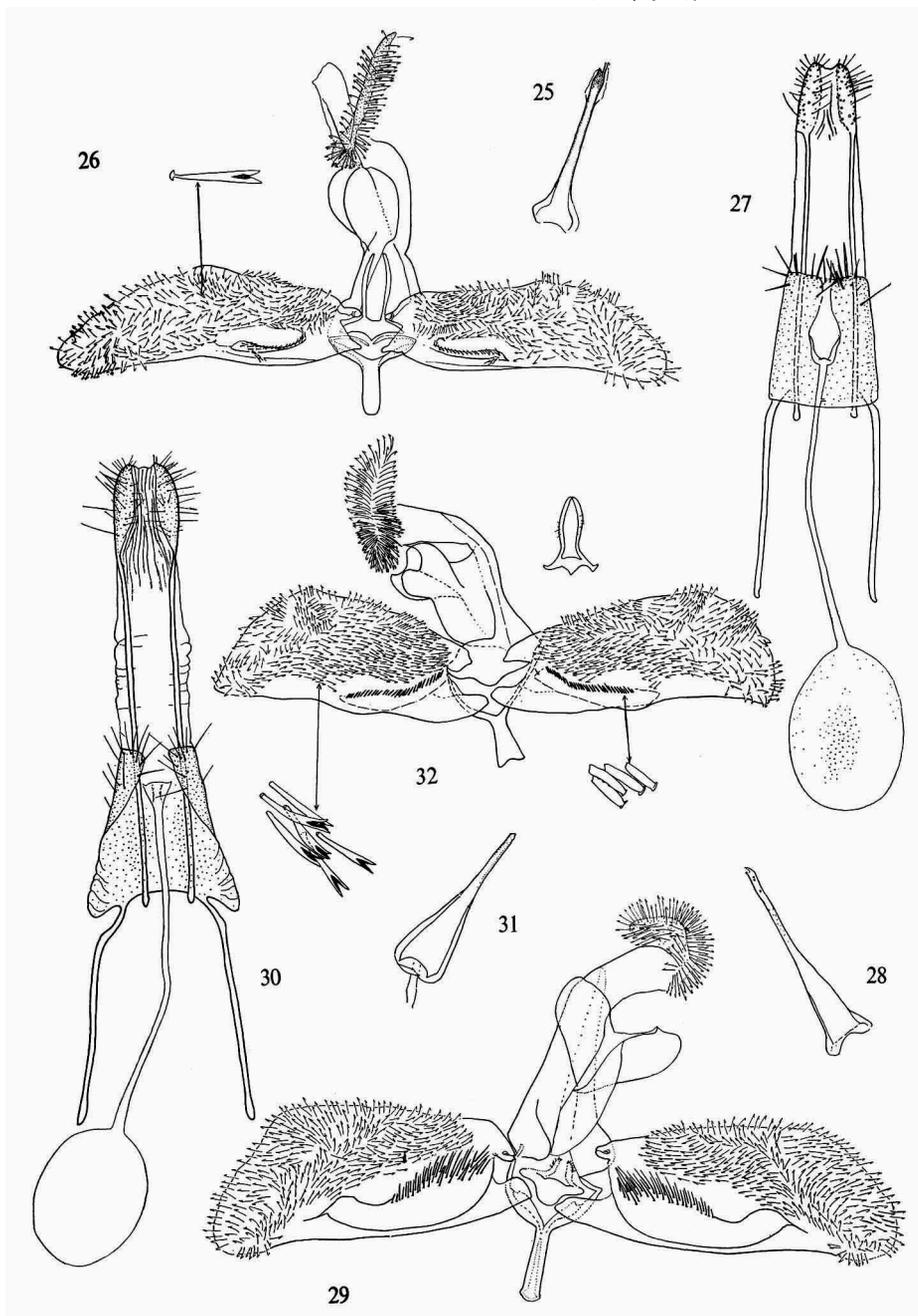


Fig. 25-32. Genitalia of Dutch Aegeriidae. 25-27, *Synanthedon myopaeformis* Bkh.: 25-26, male; 27, female. 28-30, *S. culiciformis* L.: 28-29, male; 30, female. 31-32, *S. formicaeformis* Esp., male.

**Synanthedon culiciformis** L. (fig. 28-30)

♂. Uncus recurved; with bifurcate hairs. Gnathos moderately large. Aedeagus forked at apex, not sclerotized. Valva terminally and costally covered with bifurcate hairs, apex rather blunt. Sacculus ridge with stiff and dense spines. Vinculum with a short process, somewhat dilated at base. Gen. no. 5634.

♀. Bursa egg-shaped; no signum. Ostium not sclerotized, moderately small, funnel-shaped. Ductus bursae long and narrow. Apophyses somewhat broader at tips. Gen. no. 5632.

This species is probably the same as the one indicated by Engelhardt (1946) as *Thamnosphecia culiciformis* (Linn.); in this the bursa possesses a ring-shaped granulation at the upper part, absent in the Dutch examples.

**Synanthedon formicaeformis** Esp. (fig. 31-33)

♂. Uncus with bifurcate hairs. Gnathos at the protruding part double-cardiform. Aedeagus straight, about cone-shaped with a bulbous base and a pointed apex. Valva for a greater part with bifurcate hairs; only the ventral part naked. Apex of valva pointed; sacculus ridge diagonal, covered with one row of very short spines. Vinculum with a short process with a dilated and lobate base. Gen. no. 5640.

♀. Bursa egg-shaped; no signum. Ostium funnel-shaped, enveloped by a mosaic-like structure, which is bordered by upwards-converging folds of lobi anales. Ductus bursae long and narrow, slightly dilated towards ostium. Gen. no. 5638.

**Dipsosphecia ichneumoniformis** F. (fig. 34-36)

♂. Uncus moderately small, with bifurcate hairs. Aedeagus bulbous at base, upwards slender and somewhat curved; some granules at apex. Valva costally and terminally covered with bifurcate hairs, apices pointed; sacculus ridge diagonal, clothed with one row of stiff, short spines. Vinculum with a long process. Gen. no. 5642.

♀. Bursa round and without a signum; at the upper part originate both ductus bursae and ductus bullae. Ostium about funnel-shaped. Ductus bursae almost as long as anapophyses, but twice as wide. Gen. no. 5641.

**Chamaesphecia empiformis** Esp. (fig. 37-39)

♂. Uncus small; only with a few thin hairs. Gnathos large. Aedeagus straight and very long. Valva, pointed at apex, covered with two kinds of bifurcate hairs: small bifurcate hairs along costa and cucullus large hairs in centre; the latter are darker at the forks. Vinculum with a long process. Gen. no. 5645.

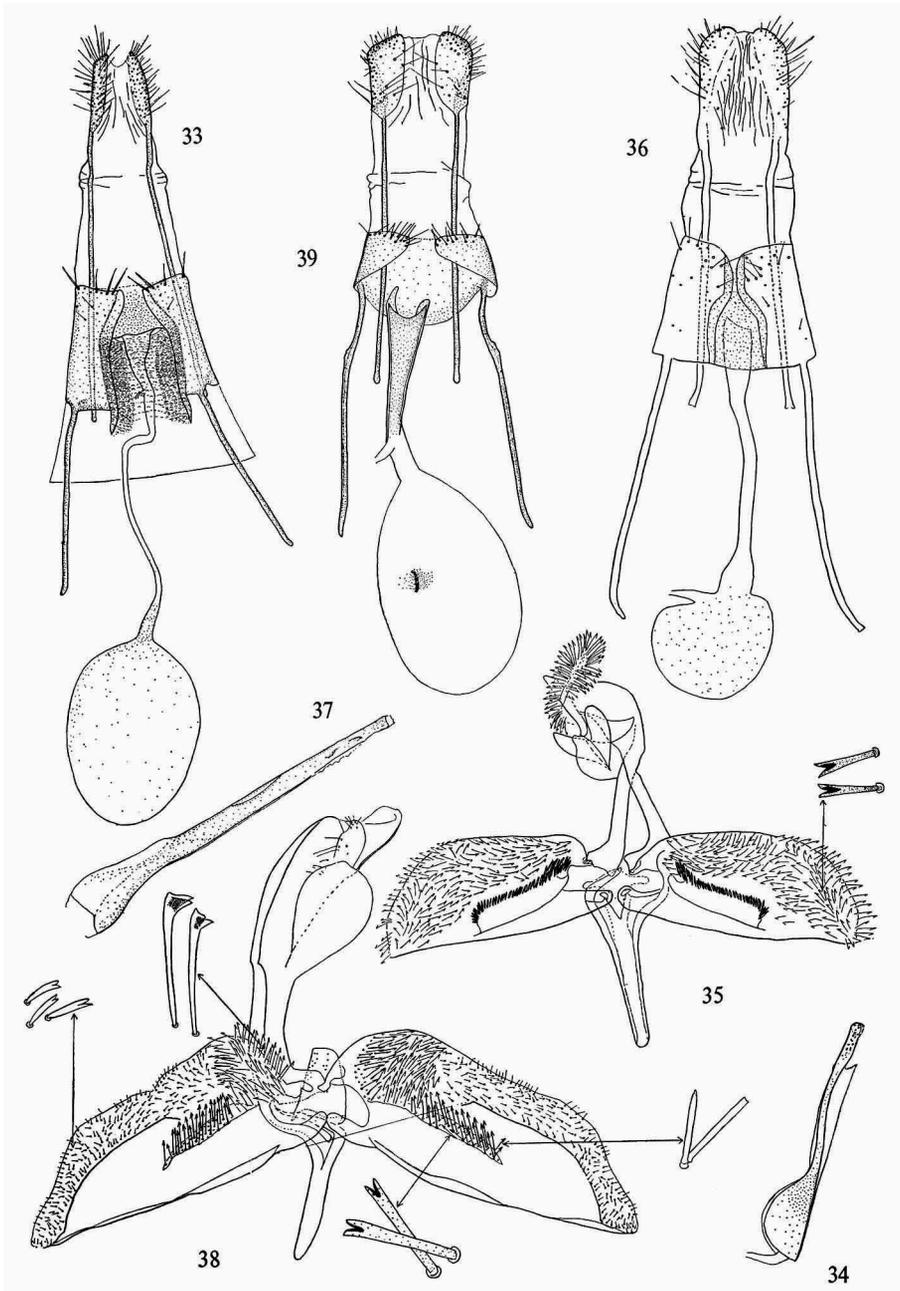


Fig. 33-39. Genitalia of Dutch Aegeriidae. 33, *Synanthedon formicaeformis* Esp., female. 34-36, *Dipsosphecia ichneumoniformis* F.: 34-35, male; 36, female. 37-39, *Chaemosphecia empiformis* Esp.: 37-38, male; 39, female.

♀. Bursa large, egg-shaped; signum bar-shaped. Ostium long and about funnel-shaped; somewhat sclerotized; juncture of ductus bullae just below the ostium. Ductus bursae wide and short. Posterior apophyses knotty at their tips. Gen. no. 5643.

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