A new European species, Adscita dujardini sp. nov. (Lepidoptera: Zygaenidae, Procridinae), confirmed by DNA analysis

Article *in* Entomologist s Gazette · July 2014

2 authors:

Konstantin A. Efetov
V.I. Vernadsky Crimean Federal University

Gerhard Tarmann
Tiroler Landesmuseen, Ferdinandeum

2014, *Entomologist's Gazette* **65**: 179–200

A new European species, *Adscita dujardini* sp. nov. (Lepidoptera: Zygaenidae, Procridinae), confirmed by DNA analysis

KONSTANTIN A. EFETOV

Crimean State Medical University, 295006 Simferopol, Crimea
efetov.konst@gmail.com

GERHARD M. TARMANN

Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Sammlungen, Feldstrasse 11a, A–6020 Innsbruck, Austria
g.tarmann@tiroler-landesmuseen.at

Synopsis

Based on morphology, *Adscita* (*Adscita*) *dujardini* sp. nov. is described from Italy, France, Switzerland and Slovenia. The differences from *A.* (*A.*) *albanica* (Naufock, 1926) are discussed. The specific status of the new taxon is also confirmed by DNA data. A key to the western Palaearctic species of the genus *Adscita* Retzius, 1783, is provided.

Key words: Lepidoptera, Zygaenidae, Procridinae, *Adscita, Adscita dujardini* sp. nov., DNA, COI mitochondrial gene, *Adscita albanica*, distributions, Italy, France, Switzerland, Slovenia, key to species.

Introduction

The nominal taxon *Procris albanica* (Naufock, 1926) was described from a syntype series consisting of 4 ♂ and 2 ♀ collected by H. Zerny and K. Predota 'auf dem Pashtrik in Albanien in der Zeit vom 4.–14. VII. 1918' and, from this series, Efetov & Tarmann (1999: 57) have selected and designated a male lectotype. The lectotype and the paralectotypes are deposited in the Naturhistorisches Museum, Wien, Austria. The contemporary status of this taxon is *Adscita* (*Adscita*) *albanica* Naufock, 1926 (Efetov & Tarmann, 1995; 1999; Efetov, 1994; 2001*a*; Efetov *et al*., 2000; 2006).

In the original description, Naufock (1926) provided only figures of the valva of the male genitalia and a ventral view of the last abdominal segments of the male. He mentioned the exceptional structure of the valva when compared with the other known species of the genus. A complete drawing of the male genitalia was provided by Agenjo (1940) and Alberti (1954). In the same publication, Alberti (1954) erroneously illustrated the female genitalia of *Adscita mannii* (Lederer, 1853) as *A. albanica*. The correct structure of the female genitalia of *A. albanica* was published by Alberti in 1971. Males of '*A. albanica*' were mainly determined by brushing off the scales of the abdomen so that the large process at the apex of each sacculus of the valvae is then visible.

The biology of this species was discovered by Efetov in the Crimea in 1989 and published in 1990 and 1992 (Efetov, 1990*a*; 1990*b*; 1992). The early stages were described by Efetov (1993; [1999*b*]). The main larval host-plant is *Geranium sanguineum* L. and another natural host-plant is *G. columbinum* L., while under laboratory conditions the larvae also readily accept other species of *Geranium* and *Erodium* (Geraniaceae) (Efetov, 1992; 2001*b*; 2005; Efetov & Tarmann, 1999). Subsequently, *G. sanguineum* was also mentioned as a larval host-plant for

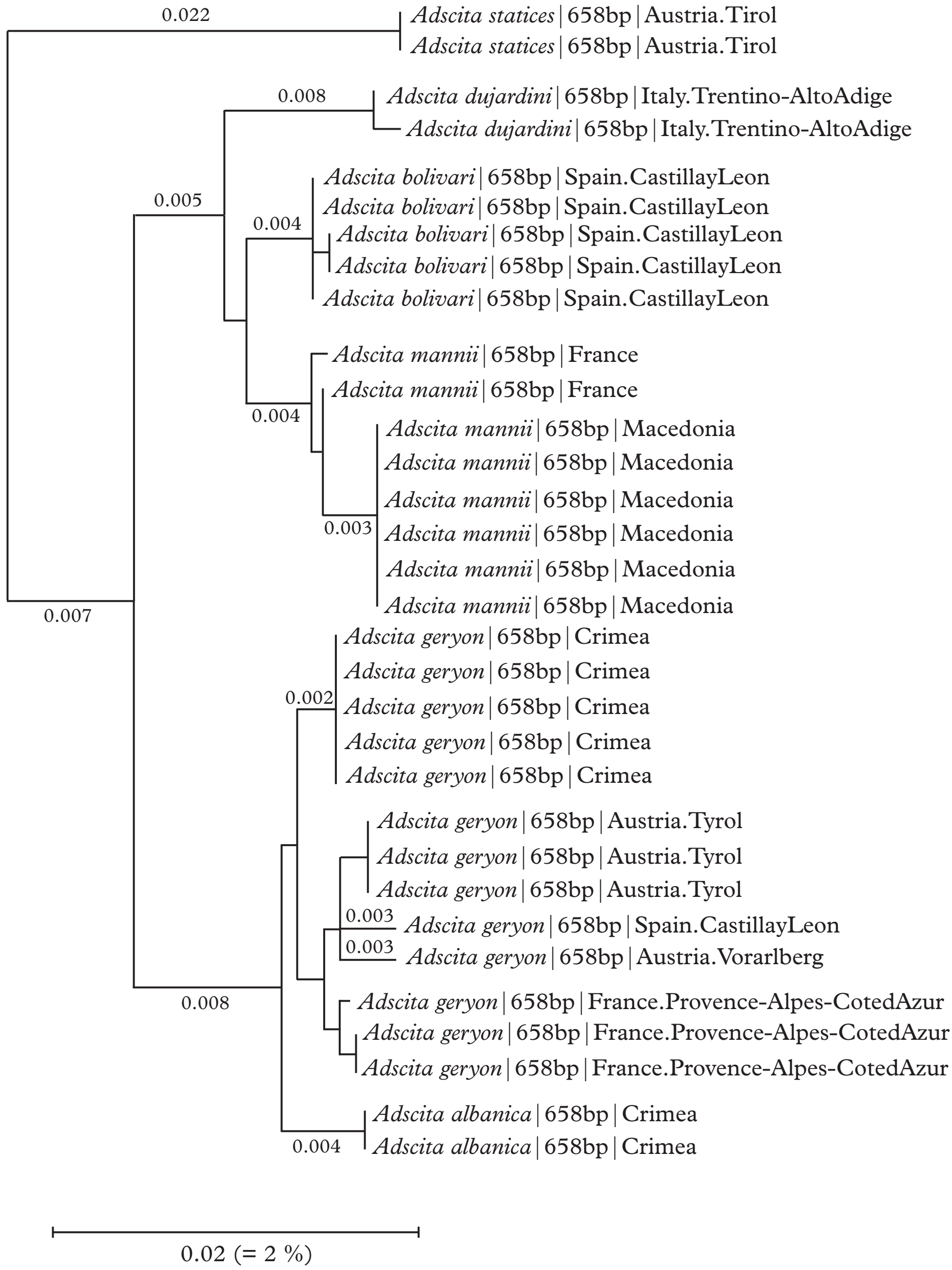
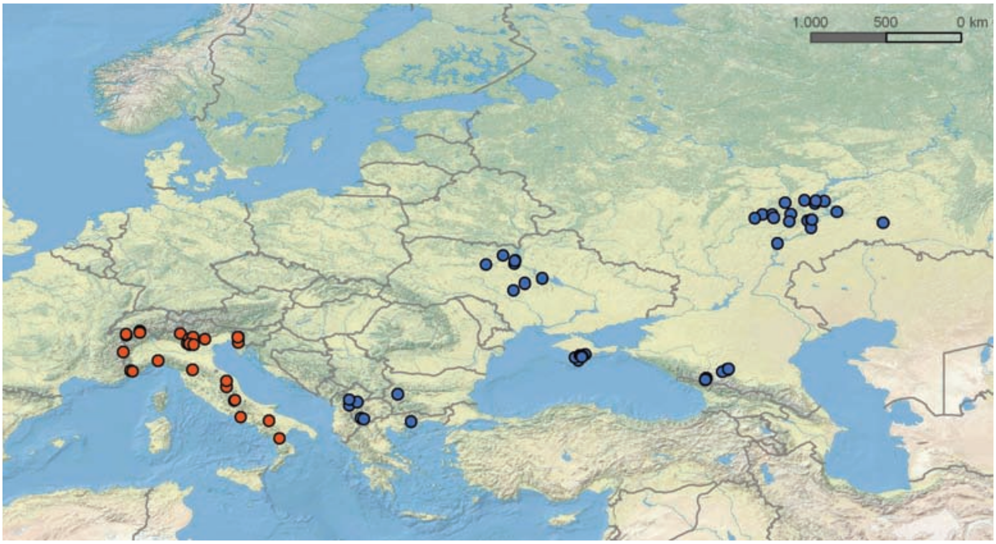


Fig. 1. Neighbour joining tree (K2P, 658 bp) of COI gene divergences among different *Adscita* species.



Map 1. Distribution map of *Adscita dujardini* sp. nov. (red) and *A. albanica* (Naufock, 1926) (blue). The map is based on the 184 data files (of both species) that are included in the BioOffice database system of TLMF.

populations in France (Billi & Varenne, 1996), Switzerland (Guenin, 1997) and northern Italy (Efetov & Tarmann, 1999).

While examining '*A. albanica*' from different localities, the present authors found two groups of specimens that have differences in habitus and genitalia morphology. This was also confirmed by DNA data (Fig. 1 – the representatives of the Italian population, Trentino, are shown under the name *Adscita dujardini*). A study of DNA barcodes (Efetov *et al.*, in prep.) showed that COI mitochondrial gene sequences were different when specimens from the Crimea and Italy were compared (distance 2.5%). This divergence is greater than that between most *Adscita* species. It is remarkable that the genetic distance between *Adscita geryon* (Hübner, 1813) (various European populations examined) and *A. albanica* from the Crimea is smaller than the distance between the two examined populations of '*A. albanica*' from Italy and the Crimea. Moreover, *Adscita mannii* (Lederer, 1853) and *Adscita bolivari* (Agenjo, 1937) also show a much smaller distance between each other and both together are still nearer to the examined Italian population of '*A. albanica*' than the latter is to the Crimean *A. albanica*.

The two morphologically different groups of specimens of '*A. albanica*' s.l. have the following distributions (Map 1). One group is distributed in the Balkans (Albania, Macedonia, Bulgaria and Greece); in Ukraine (Kiev Region, Zhitomir Region, Cherkassy Region); in the Crimea and in Russia: Northern Caucasus (Stavropol Territory), Volga Basin (Ul'yanovsk Region, Penza Region, Samara Region, Saratov Region, west of Orenburg Region). The second group occurs in south-eastern France (Alpes-Maritimes), Switzerland (Valais), Italy and Slovenia (Trnovo region). As the type locality of *Procris albanica* Naufock, 1926, is situated in Albania, it is necessary to describe a nominal taxon for the representatives of the second group.

Depositories of material

Naturhistorisches Museum, Wien, Austria (NHMW); Tiroler Landesmuseen, Ferdinandeum, Innsbruck, Austria (TLMF); Collection K. A. Efetov, Crimean State Medical University, Simferopol, Crimea (KAE); Collection Eric Drouet, Gap, France (EDF); Bulgarian Natural History Museum, Sofia, Bulgaria; Collection R. Guenin, Wabern, Switzerland; Collection W. Wagner, Kronburg, Germany; Eidgenössische Technische Hochschule, Zürich, Switzerland; Hungarian Natural History Museum, Budapest, Hungary; Löbbecke Museum und Aquazoo, Düsseldorf, Germany; Museo Civico di Storia Naturale, Verona, Italy; Museum Haus der Natur, Salzburg, Austria; Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands; Schmalhausen Institut of Zoology, Kiev, Ukraine; Staatliches Museum für Naturkunde, Karlsruhe, Germany; Natural History Museum (BMNH), London, U.K.; Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany; Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; Zoological Museum of Lomonosov Moscow University, Moscow, Russia; Zoological Museum of Shevchenko National University, Kiev, Ukraine; Zoologische Sammlungen des Bayerischen Staates, Munich, Germany.

Adscita (*Adscita*) *dujardini* sp. nov.

Derivatio nominis. This species is named in honour of the French lepidopterist Francis Dujardin (1910–1984, originally from Winnipeg, died in Nice) (Fig. 30) who already suspected that Italian populations of '*Procris albanica*' belong to another 'subspecies' rather than the nominotypical populations from the Balkans. This can be seen from his handwritten labels ('1970 // *Procris* // *albanica* Nfck. // ssp. nova ♂') on two male specimens deposited in Tiroler Landesmuseen, Ferdinandeum, Innsbruck, Austria (Fig. 11).

MATERIAL EXAMINED

In citing the pin-label data, the symbol '//' denotes the end of a line; handwritten inscriptions are listed in brackets { }.

Holotype ♂ (Fig. 16). **Italy**. With printed pin-labels: 'ITALIA centr., // Prov. Macerata, // Monte San Vicino W, *ca* 3 // km SW. Pian dell' Elmo, // 1180–1190 m, 14.vi.2012; // E 13°03′21″ / N 43°19′30″ // leg. G. M. Tarmann' (Fig. 17) (TLMF).

Paratypes. **Italy**: 14 ♂, 6 ♀ (Fig. 9), with pin-labels: 'ITALIA centr., // Prov. Macerata, // Monte San Vicino W, *ca* 3 // km SW Pian dell' Elmo, // 1180–1190 m, 14. vi. 2012; // E 13°03′21″ / N 43°19′30″ // leg. G. M. Tarmann' (genitalia preparations: 6 ♂ – Z 3608, Z 3610, Z 3613, Z 3614, Z 3616, Z 3617, 2 ♀ – Z 3609, Z 3611) (12 ♂, 4 ♀ – TLMF, 2 ♂, 2 ♀ – KAE, 2 ♂ – EDF); 1 ♂ with pin-labels: 'ITALIA, Liguria // Prov. Genova // Pso. d. Turchino // 500 m {5}.6.[19]7{9} // leg. Aistleitner'; '{*Adscita* ♂ // *(Adscita)* // *albanica* NAUF.} // Datum {12.4.85} // Präp. {Z 2014} // det. G. Tarmann // (Innsbruck)' (TLMF); 1 ♂ with pin-labels: '{SALBERTRAND // Val Susa ±1000 m. // TORINO. ITALIA // 29.VI.1987 // E. Drouet leg.'; '{*Adscita* ♂ // *(Adscita)* // *albanica* NAUF.} // Datum {1.9.87} Rev. Nr. {2550} // Präp. {Z 2311} // det. G. Tarmann // (Innsbruck)' (EDF); 2 ♂ with pin-label: 'ITALIA // Prov. Trento, Pomarolo, // Savignano, 600 m, 18.7.2002, // Huemer leg. // TLMF 2007-130', both specimens barcoded, barcode numbers 'PPAAalb#003' (KAE) and 'PPAAalb#004' (TLMF); 1 ♀ with pin-labels: 'ITALIEN, Trentino, // Pomarolo, TR 62, // Quercetum pubescentis // 21.vii.1993; leg. P. Huemer // E 11°02′28″ / N 45°56′22″ // Gen. prep. Z 2706 ♀' ; '*Adscita (Adscita)* ♀ // *albanica* // (Naufock, 1926) // det. G. M. Tarmann // 01.xii.1993 // Gen.präp. Z 2706 ♀' (TLMF); 2 ♂ with pin-label: 'ITALIA sept. // Gardaseegebiet // Pregasina (TN) // 600–650 m // 18. 6. 1977 // leg. G. TARMANN' and determination pin-labels (respectively) '*Adscita (Adscita)* // *albanica* (Naufock) // det. G. M. Tarmann // 27.xii.1996 // Z 0509 ♂'; '*Adscita (Adscita)* // *albanica* (Naufock) // det. G. M. Tarmann // 27.xii.1996 // Z 0510 ♂' (TLMF); 1 ♂ with pin-labels: 'ITALIA sept. // Gardaseegebiet // Pregasina (TN) // 600–650 m // {25.6.1977} // leg. G. TARMANN'; '*Adscita (Adscita)* // *albanica* (Naufock) // det. G. M. Tarmann // 27.xii.1996 // Z 0727 ♂' (TLMF); 1 ♂ with pin-label: 'ITALIA sept. // Prov. Verona // Monte, 300 m, // 18.6.1985', 'leg. // K. BURMANN // et // G. TARMANN' (TLMF); 2 ♂ with pin-label: 'ITALIA sept. // Prov. Verona // Monte, 300 m, // 25–28.vi.1987 // leg. G. M. Tarmann' (TLMF); 1 ♀ with pin-label: 'ITALIA sept. // Prov. Verona, Monte, // 300 m, 25.vi.1987 // leg. G. M. Tarmann // *A. albanica* (NAUF) // Z 2304 ♀' (TLMF); 3 ♂ with pin-label: 'ITALIA sept. // Prov. Verona // Monte, 200–400 m, // 16.vi.1988 // leg. G. M. Tarmann' (TLMF); 1 ♂ with pin-label: 'VERONA // {Cancello // 29–6–[1]946} // G. B. Cartolari', '{FP

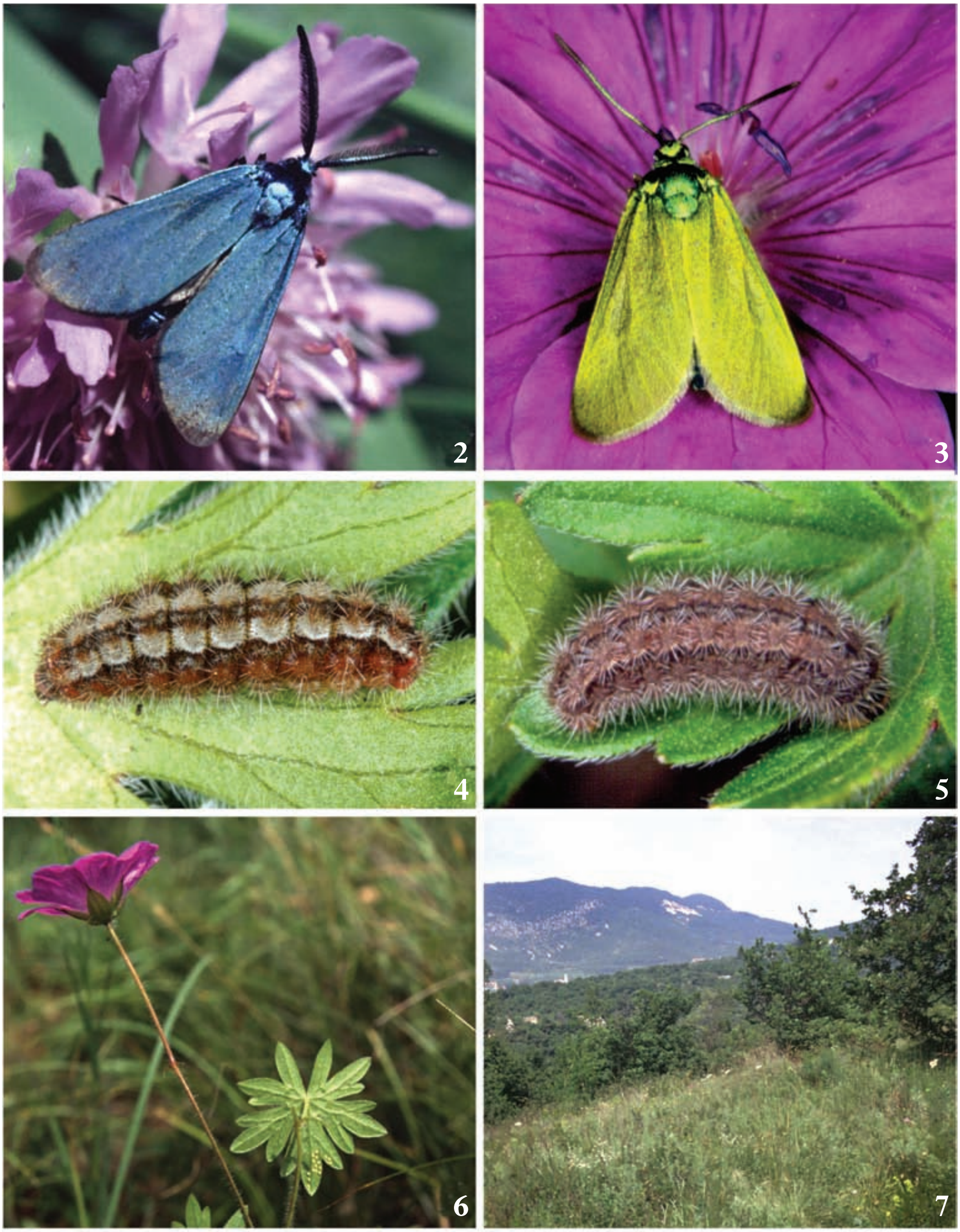
// 0020}', '{Z217}' (TLMF); 1 ♂ with pin-labels: 'LUCANIA, M.te Vulture // dint. Laghi di Monticchio // m {12}50 {14.VI}. 196{7} // coll. F. Hartig'; '{1970 // *Procris* // *albanica* Nfck. // ssp. nova ♂} // FRANCIS DUJARDIN determinavit // PARATYPE' ['FRANCIS DUJARDIN determinavit // PARATYPE' – in red colour]; '*Adscita (Adscita)* // *albanica* (Naufock) // det. G. M. Tarmann // 27. xii. 1996 // Z 0910 ♂' (TLMF); 1 ♂ (Fig. 10) with pin-labels (Fig. 11): 'LUCANIA, M.te Vulture // dint. Laghi di Monticchio // m {12}50 {18.VI}. 196{8} // coll. F. Hartig (TLMF); '{1970 // *Procris* // *albanica* Nfck. // ssp. nova ♂} // FRANCIS DUJARDIN determinavit // PARATYPE' ['FRANCIS DUJARDIN determinavit // PARATYPE' – in red colour] (TLMF); 1 ♂ with pin-label: 'LUCANIA, M.te Vulture // dint. Laghi di Monticchio // m {12}50 {22.VI}. 196{7} // coll. F. Hartig'; 1 ♂ with pin-labels: 'LUCANIA, M.te Vulture // dint. Laghi di Monticchio // m {12}50 {23.VI}. 196{7} // coll. F. Hartig'; 'DETÉRMINÉ PAR FRACIS DUJARDIN // {*Procris albanica* Nfck. ♂} // PRÉPARATION GENITALIA N° {B.11.70}' (TLMF); 1 ♂ with pin-label: 'LUCANIA, M.te Vulture // dint. Laghi di Monticchio // m {10}00 {12.VI}. 196{9} // coll. F. Hartig' (TLMF); 1 ♂ with pin-labels: 'CALABRIA // {M. Manfriano // 27–V–[19]53} // leg. S. Zangheri'; '{Z 3848}' (TLMF); 1 ♂ with pin-label: 'CALABRIA // {M. Manfriano // 27–V–[19]53} // leg. S. Zangheri' (TLMF). **France**: 1 ♂ with pin-labels: '{CAMARI. 820 m // SAINT COLOMBAN // ALPES MARITIMES // 01–VII–1997 // E. Drouet leg.'; '{*A. albanica* // brossage ♂}'; 'Nombre articles antenne droite // bouton {7} flagelle {30} // Total {37} // Longueur aile ant: {12 mm.}' (EDF); 1 ♂ with pin-labels: '{CAMARI. 800 m // SAINT COLOMBAN // LANTOSAUE // 01–VII–1997 // E. Drouet leg. // ALPES MARITIMES'; '{*A. albanica* // ♂ // brossage }'; 'Nombre articles antenne droite // bouton {9} // Flagelle {30} // Total {42} // {longueur aile ant: {11 mm}' (EDF); 1 ♂ with pin-labels: 'Vallon du Romarin 1300–1550m // Ancienne route du col 32TLP88 // TENDE ALPES MARITIMES // 06–VII–2009 // Eric DROUET legit'; 'Nombre articles antenne droite // bouton {7} flagelle {29} // Total {36} // Longueur aile ant: {12 mm.}' (EDF); 1 ♂ with pin-labels: 'Cagnourina 1120m // TENDE FRANCE // ALPES MARITIMES // 07–VII–2009 32TLP88 // Eric DROUET legit'; 'Nombre articles antenne droite // bouton {8} flagelle {30} // Total {38} // Longueur aile ant: {11,5 mm}'; '{Z 3860}' (EDF); 1 ♂ (Fig. 8) with pin-labels: 'Cagnourina 1120m // TENDE FRANCE // ALPES MARITIMES // 07–VII–2009 32TLP88 // Eric DROUET legit'; 'Nombre articles antenne droite // bouton {8} flagelle {30} // Total {38} // Longueur aile ant: {11,5 mm.}' (EDF); 1 ♂ with pin-labels: '{Vallon du Romarin // route du col de Tende // TENDE. 06–VII–2009 // ALPES MARITIMES // E. Drouet leg.}'; 'Nombre articles antenne droite // bouton {8} flagelle {30} // Total {38} // Longueur aile ant: {12 mm.}'; '{Z 3861}' (EDF).

All the above-listed specimens have been supplied with printed pin-labels on red paper 'HOLOTYPUS [or PARATYPUS] // *Adscita dujardini* // ♂ [or ♀] // K. A. Efetov & // G. M. Tarmann, 2014'.

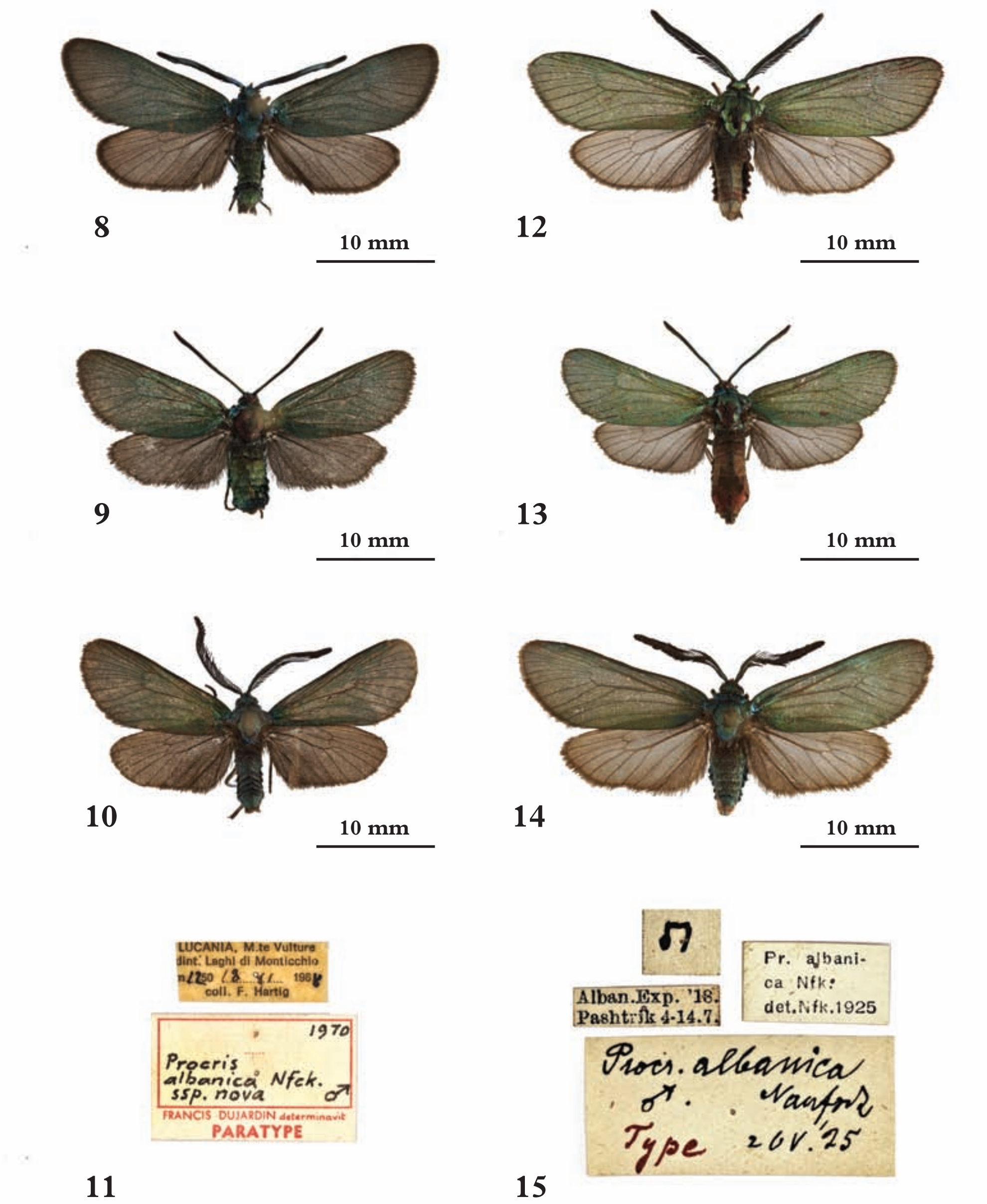
Description

Habitus of male and female similar, female only slightly smaller than male and with unpectinated antenna. Length of body: male 8.6–11.0 mm, female 8.4 mm; length of forewing: male 10.9–14.0 mm, female 11.1–11.2 mm; breadth: male 4.8–6.2 mm, female 4.7 mm; length of hindwing: male 8.4–11.1 mm, female 8.2 m; breadth: male 4.2–5.3 mm, female 4.2–4.3 mm; length of antenna: male 6.4–7.9 mm, female 6.9–7.5 mm. Frons and occiput dark green with submetallic sheen. Antenna strongly covered with bluish green shiny scales, clubbed, bipectinate in male, biserrate in female, length of pectination in middle part of male antenna *ca* 1.0 mm; number of segments 34–40 in male (6–8 apical segments forming club), 36–38 in female; ratio of breadth of 4th segment from apex to breadth of 15th segment in dorsal view nearly 1.3. Proboscis well developed, black or blackish brown. Patagia and tegulae green or bluish green with submetallic sheen. Thorax thickly covered with green or bluish green shiny scales. Forewing upperside green or bluish green with submetallic sheen, thickly covered with shiny scales; underside of forewing grey, with a few green shiny scales in the basal area; fringe brownish grey. Hindwing upper- and underside dark brownish grey; fringe concolorous; costal and anal margins of hindwing underside covered with green shiny scales. Legs greenish black, thickly covered with shiny scales, foreleg without tibial epiphysis, hind tibia with one pair of spurs (apical). Abdomen dark green with submetallic sheen, thickly covered with scales.

Genitalia male (Figs 18, 20–22). Uncus heavily sclerotized, 1.8–1.9 times longer than tegumen. Valva with prominent pointed process at apex of sacculus. Aedeagus (phallus) 1.6–1.8 times longer than uncus, with one large, straight, heavily sclerotized cornutus with pointed apex, length of cornutus 1.5–1.8 times shorter than length of aedeagus, length of cornutus 11–14 times longer than its maximal breadth.

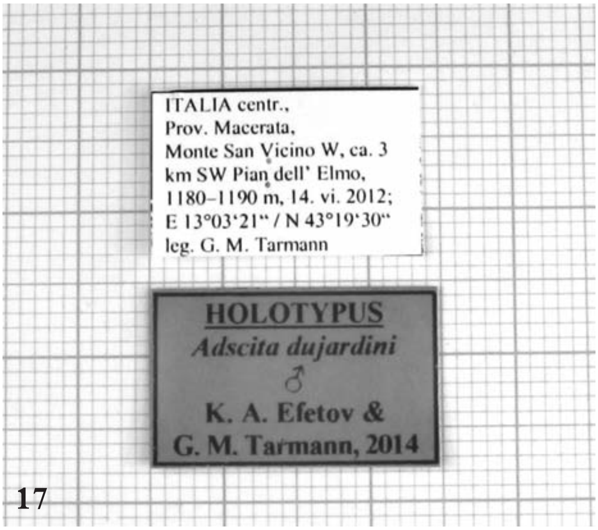


Figs 2–7. *Adscita* spp. 2, *A. dujardini* sp. nov., male, Italy, Trentino, Pomarolo (*photo*: S. Erlebach). 3, *A. albanica* (Naufock, 1926), female, Crimea, Mt. Chatyr-Dag (*photo*: K. A. Efetov). 4, *A. dujardini* sp. nov., adult larva, Switzerland, Valais, Stalden (*photo*: W. Wagner). 5, *A. albanica* (Naufock, 1926), adult larva, Crimea, vic. Krasnoles'ye (*photo*: K. A. Efetov). 6, *A. dujardini* sp. nov., eggs on *Geranium sanguineum*, Italy, Verona, Monte (*photo*: G. M. Tarmann). 7, habitat of *A. dujardini* sp. nov., Italy, Verona, Monte (*photo*: G. M. Tarmann).



Figs 8–15. *Adscita* spp. 8–11, *A. dujardini* sp. nov. 8, paratype male, France, Alpes-Maritimes, Cagnourina, 7.vii.2009 (*E. Drouet*). 9, paratype female, Italy, Macerata, Monte San Vicino, 14.vi.2012 (*G. M. Tarmann*). 10, paratype male, Italy, Lucania (= Basilicata), Laghi di Monticchio, 18.vi.1968 (*F. Hartig*). 11, pin-labels of this paratype – fig. 10 [it can be recognised from Dujardin's pin-label that he already wanted to describe this population as a subspecies of *Procris albanica*] (*photos*: S. Heim). 12–15, *A. albanica* (Naufock, 1926). 12, male, Crimea, vic. Krasnoles'ye, 3.vi.1996 (*K. A. Efetov*). 13, female, Crimea, vic. Krasnoles'ye, 3.vi.1996 (*K. A. Efetov*). 14, paralectotype male, Albania, Pashtrik, 4–14.vii.1918 (*H. Zerny & K. Predota*). 15, pin-labels of this paralectotype (lower handwritten label by A. Naufock). (*Photos*: S. Heim.)

16



17

Figs 16, 17. *Adscita dujardini* sp. nov. 16, holotype male, Italy, Macerata, Monte San Vicino, 14.vi.2012 (*G. M. Tarmann*). 17, pin-labels of the holotype. (*Photos*: K. A. Efetov).

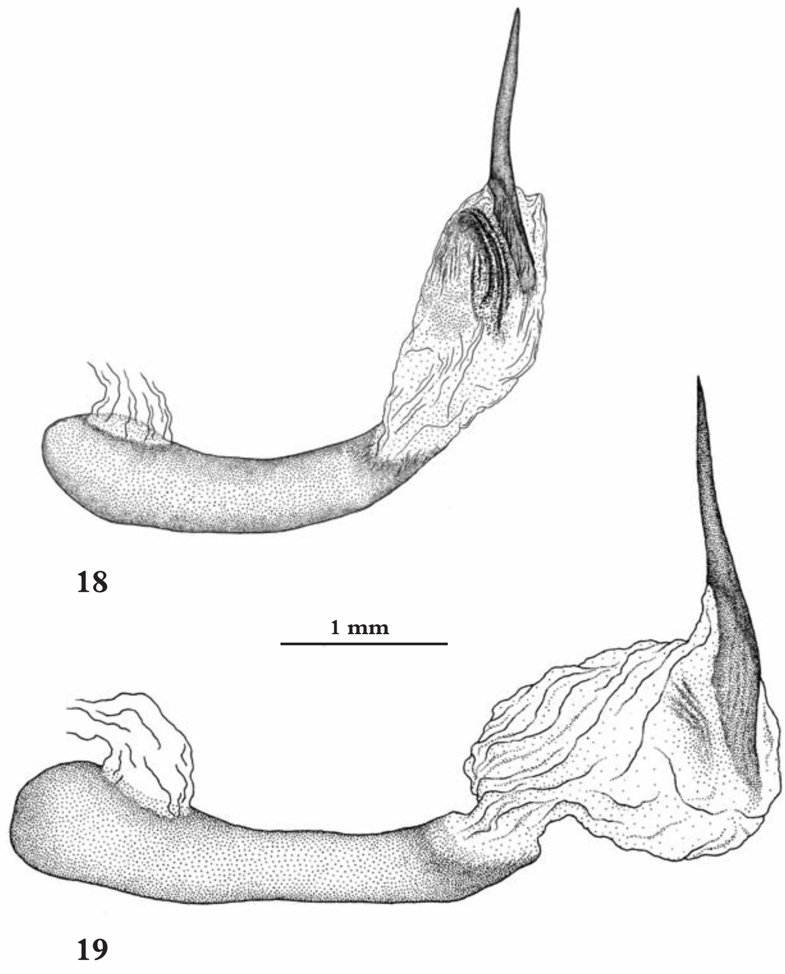
Genitalia female (Figs 26, 28). Ostium narrow, sagitally slit-shaped. Antrum strongly sclerotized, funnel-shaped. Caudal part of ductus bursae strongly dilated, forming a praebursa; praebursa without proximal dorsal sclerotization (as in *A. albanica*) and sclerotized dentations (as in *A. mauretanica*), irregular in shape, with folded walls, its breadth greater than its length; distal part of ductus bursae (ductus intrabursalis) a prolongation of distal end of praebursa. Corpus bursae single, ovoid, translucent.

Biology

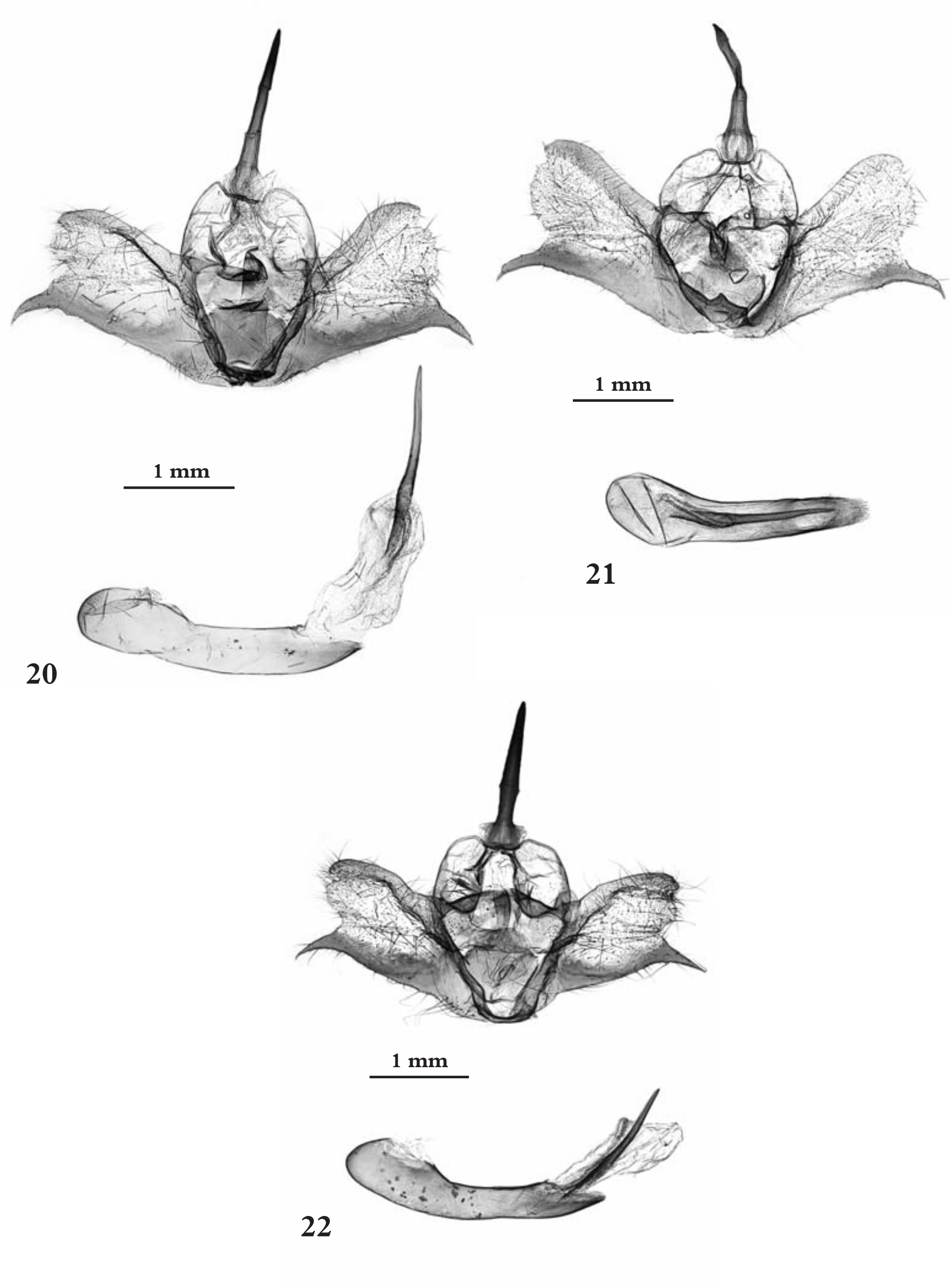
The larvae feed on *Geranium sanguineum*. The yellow eggs are deposited singly or in small groups on the underside of the leaves of the host-plant (Fig. 6; Guenin, 1997: 413, fig. 2). Larvae of the first instar are leaf mining, later instars feed freely on the leaves. Pupation takes place in a silky, white, spindle-shaped cocoon. The pupa is light brown (Guenin, 1997: 413, fig. 4). The flight period of the imago varies from the end of May (Calabria) to the end of July (Alps). Adults can often be observed nectaring from the underside of the flowers of *Geranium sanguineum* with the proboscis between the petals (Guenin, 1997). The habitats in the Alps are rocky, mountain steppe biotopes (Guenin, 1997: fig. on page 414) or dry grassy places (Fig. 7); in central and southern Italy the habitats are forest clearings where the larval host-plant grows in half-shadow under trees and bushes.

Distribution

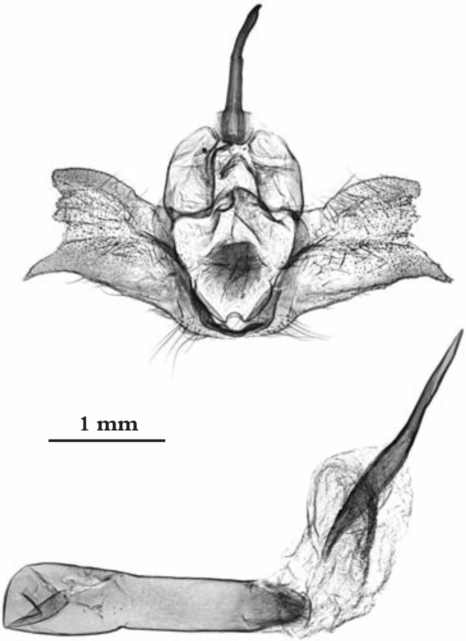
Based on the localities of *A. dujardini* sp. nov. known to the authors (personal data, information provided by R. Guenin and E. Drouet and from the literature (Bertaccini & Fiumi, 1999)).



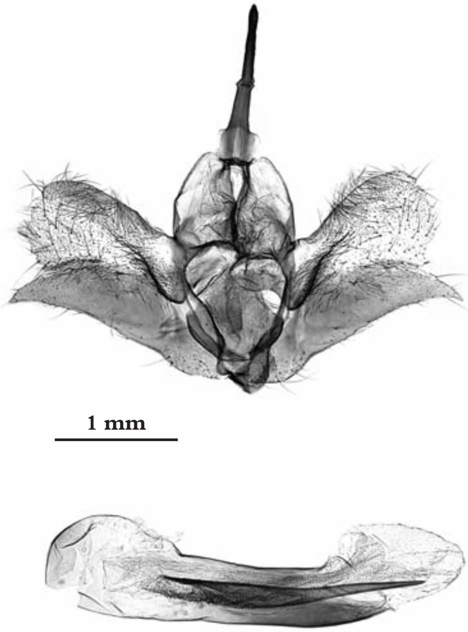
Figs 18, 19. *Adscita* spp. Aedeagus with everted vesica. 18, *A. dujardini* sp. nov., paratype, Italy, Macerata, Monte San Vicino, 14.vi.2012 (*G. M. Tarmann*) (gen. prep. Z 3613). 19, *A. albanica* (Naufock, 1926). Crimea, Kurlyuk-Bash, 3.vi.1989 (*K. A. Efetov*) (gen. prep. in glycerol pinned under the specimen).



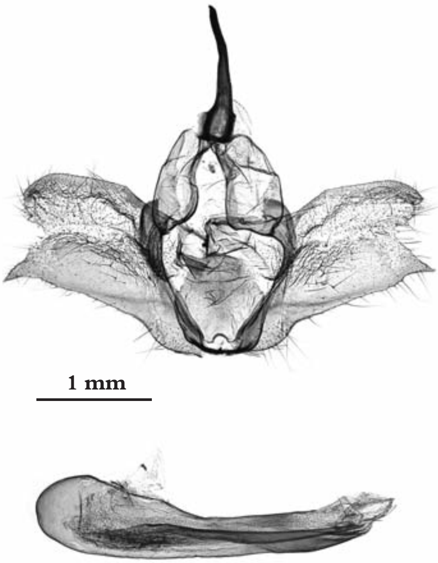
Figs 20–22. *Adscita dujardini* sp. nov., paratypes, male genitalia. 20, Italy, Macerata, Monte San Vicino, 14.vi.2012 (*G. M. Tarmann*) (gen. prep. Z 3616). 21, Italy, Lucania (= Basilicata), Laghi di Monticchio, 14.vi.1967 (*F. Hartig*) (gen. prep. Z 910). 22, France, Alpes-Maritimes, route du col de Tende, 6.vii.2009 (*E. Drouet*) (gen. prep. Z 3861).



23



24



25

Figs 23–25. *Adscita albanica* (Naufock, 1926), male genitalia. 23, paralectotype, Albania, Pashtrik, 4–14.vii.1918 (*H. Zerny & K. Predota*) (gen. prep. Z 3851). 24, Russia, Northern Caucasus, Beshtau, vic. Pyatigorsk, 7.vi.1970 (*H. Muche*) (gen. prep. Z 389). 25, Russia, vic. Saratov, 25.vi.–12.vii.1970 (gen. prep. Z 1790).

France. Alpes-Maritimes: Cagnourina, Camari, Col d'Able, Vallon de Saint Colomban (Lantosque), Vallon du Romarin. **Switzerland**. Valais/Wallis: Baltschieder, Branson, Chibo, Dorenaz, Martigny, Plan Cerisier, Stalden, Zeneggen. **Italy**. Brescia: Vico (Val Corteno); Cosenza: Monte Manfriana (Monte Pollino SW.); Genova: Casa Cornua, Monte Fasce, Passo di Turchino, Recco; Imola: Colla Velosa; L'Aquila: Ovindoli, Rocca di Mezzo; Latina: Valle del Petrella (Monti Aurunci); Macerata: Lago di Fiastra, Monte San Vicino; Pistoia: Montesecco; Potenza: Laghi di Monticchio (Monte Vulture); Torino: Salbertrand (Valle di Susa); Trentino: Laghi di Cei, Pregasina, Riva del Garda, Savignano/Pomarolo; Treviso: Monte Grappa; Trieste: Duino, Trieste; Verona: Albisano, Cancello, Monte, San Giorgio di Valpolicella. **Slovenia**. Trnovo, 'Ternowaner Wald'.

Adscita (*Adscita*) *albanica* (Naufock, 1926)

Procris albanica Naufock, 1926: (126).
Procris jegorowi Alberti, 1971: 76 [nomen nudum].

TYPE MATERIAL EXAMINED

Lectotype ♂ (designated by Efetov & Tarmann, 1999: 57). **Albania**. With pin-labels: '11.7' (white paper, printed); 'Alban. Exp. '18. // Pashtrik 4–14.7.' (white paper, printed); '{Type nº 2 ♂ // *Procris albanica* // V. d. z. b. Gesch. Wien // Jhg. 1924–1925 // pag. 126. // Albert Naufock.}' (pink paper, black frame, handwritten by A. Naufock); 'Original // zur Abbildung des // {*P. albanica* ♂} // im Seitz, Suppl., // Bd. 2, Tafel {1b} // 1930. H. Reiss.' (white paper, black frame, handwritten inscriptions by H. Reiss); 'Sammlung // Albert Naufock' (white paper, printed); 'LECTOTYPUS //{*Procris albanica* // Naufock, 1926 // ♂} // K. A. Efetov & // G. M. Tarmann // design. 1998' (red paper, black frame, handwritten inscription by K. A. Efetov) (NHMW).

Paralectotypes. **Albania**. 1 ♂ (Fig. 14), with pin-labels (Fig. 15): 'Alban. Exp. '18. // Pashtrik 4–14.7.' (white paper, printed); 'Pr. albani- // ca Nfk. // det.Nfk.1925' (white paper, printed); '{51}' (white paper, handwritten); '{*Procr. albanica* // ♂. Naufock // Type 26 V. '25}' (white paper, handwritten by A. Naufock, 'Type' written red colour); 'PARALECTOTYPUS //{*Procris albanica* // Naufock, 1926 // ♂} // K. A. Efetov & // G. M. Tarmann // design. 1998' (red paper, black frame, handwritten inscription by K. A. Efetov) (NHMW). 1 ♂, with pin-labels: '8.7' (white paper, printed); 'Alban. Exp. '18. // Pashtrik 4–14.7.' (white paper, printed); 'Pr. albani- // ca Nfk. // det.Nfk.1925' (white paper, printed); '{52}' (white paper, handwritten); '{*Procr. albanica* // ♂ Naufock // Type 26 V. '25.}' (white paper, handwritten by A. Naufock, 'Type written in red colour); 'PARALECTOTYPUS //{*Procris albanica* // Naufock, 1926 // ♂} // K. A. Efetov & // G. M. Tarmann // design. 1998' (red paper, black frame, handwritten inscription by K. A. Efetov); '{Z 3851}' (NHMW). 1 ♀, with pin-labels: 'Alban. Exp. '18. // Pashtrik. 4–14.7' (white paper, printed); '{Type nº 3 ♀ // *Procris albanica* // V. d. z. b. Gesch. Wien // Jhg. 1924–1925 // pag. 126. // Albert Naufock.}' (pink paper, handwritten by A. Naufock); 'Original // zur Abbildung des // {*P. albanica* ♀} // im Seitz, Suppl., // Bd. 2, Tafel {1c} // 1930. H. Reiss.' (white paper, black frame, handwritten inscriptions by H. Reiss); 'Sammlung // Albert Naufock' (white paper, printed); 'PARALECTOTYPUS //{*Procris albanica* // Naufock, 1926 // ♀} // K. A. Efetov & // G. M. Tarmann // design. 1998' (red paper, black frame, handwritten inscription by K. A. Efetov) (NHMW). 1 ♀, with pin-labels: 'Alban-Exp. '18. // Pashtrik, 4–14.7.' (white paper, printed); 'Pr. geryon // Hb. {♀}// det.Nfk.1925' (white paper, printed, handwritten inscription); '{*Procr. albanica* // ♀ Naufock // Type 26 V '25.}' (white paper, handwritten by A. Naufock, 'Type' written in red colour); 'PARALECTOTYPUS //{*Procris albanica* // Naufock, 1926 // ♀} // K. A. Efetov & // G. M. Tarmann // design. 1998' (red paper, black frame, handwritten inscription by K. A. Efetov); '{Z 3852}' (NHMW).

Many specimens from the Balkans (Macedonia, Bulgaria); Ukraine: Kiev Region, Zhitomir Region, Cherkassy Region; Crimea (Figs 12, 13); Russia: Northern Caucasus (Stavropol Territory) and Volga Basin (Ulyanovsk Region, Penza Region, Samara Region, Saratov Region, west of Orenburg Region) were also examined.

Differential diagnosis

The most closely related species to *Adscita dujardini* sp. nov. is *A. albanica*, but the latter has good differences in the morphology of the larvae and adults, in the sequence of the COI gene and in its distribution.

Table 1. Differential characters of *Adscita dujardini* and *A. albanica*.

Parameters	***Adscita dujardini* sp. nov.**	***Adscita albanica***
Length of uncus (mm)	1.40–1.65	1.20–1.45
Breadth of sclerotization in middle of ventral part of valva (mm)	0.015–0.045	0.035–0.055
Length of aedeagus (mm)	2.40–2.85	2.60–2.90
Length of cornutus (mm)	1.45–1.85	2.10–2.40
Ratio of lengths of uncus/tegumen	1.76–1.91	1.35–1.64
Ratio of lengths of aedeagus/uncus	1.61–1.81	1.90–2.33
Ratio of lengths of aedeagus/cornutus	1.50–1.81	1.09–1.30
Ratio of length of praebursa to its breadth	0.64–0.68	1.00–1.35

The adults of *A. dujardini* have a dark green or bluish green forewing upperside and a more or less opaque hindwing (Figs 2, 8–10), while in *A. albanica* the forewing is yellowish green and the hindwing is more translucent (Figs 3, 12–14). This can also be seen in de Freina & Witt (2002: 443, pl. 13, figs 33.1–33.8) where the figures of the two species are mixed (*A. dujardini* sp. nov.: figs 33.1, 33.3; *A. albanica*: figs 33.2, 33.4–33.8).

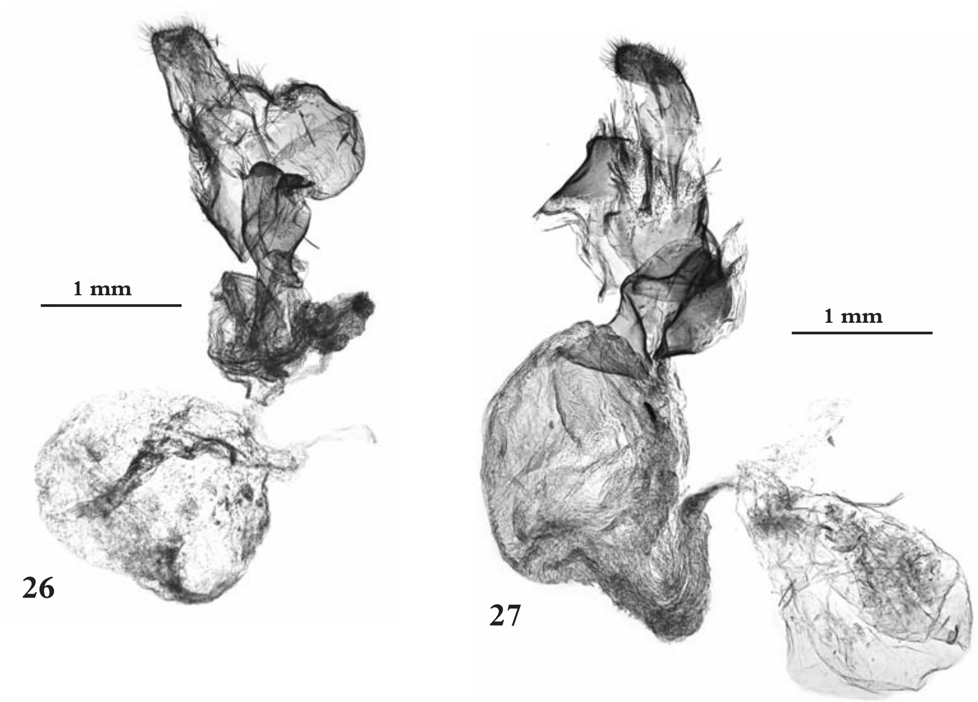
The adult larvae also have different coloration: that of *A. albanica* is nearly uniformly dark brown (Fig. 5; Efetov & Tarmann, 1999: fig. 363; Efetov, 2001b: pl. 56, fig. 6; Efetov, 2005: pl. 19, fig. 6), while that of *A. dujardini* sp. nov. has two very well visible lines of white dorsal verrucae (Fig. 4; Guenin, 1997: 412, fig. 1; 413, fig. 3). As far as it is known this character is constant.

In the male genitalia of *A. dujardini* sp. nov. (Figs 18, 20–22) the uncus is longer, the sclerotization of the ventral part of the valva is narrower and the cornutus is shorter than in *A. albanica* (Figs 19, 23–25). In *A. dujardini* the ratio of the lengths of the uncus/tegumen is greater, the aedeagus/uncus is smaller and the aedeagus/cornutus is greater than in *A. albanica* (see Table 1). Moreover, in most specimens the process at the apex of the valva is narrower and longer in *A. dujardini* than in *A. albanica*.

The antrum of the female genitalia of *A. albanica* (Fig. 29) is more or less pot-shaped (not funnel-shaped as in *A. dujardini* (Fig. 28)) and the length of the praebursa is equal to or greater than its breadth (Fig. 27) (in *A. dujardini* the breadth of the praebursa is greater than its length (Fig. 26)) (see Table 1). Moreover, the praebursa of *A. albanica* has a proximal dorsal sclerotization (absent in *A. dujardini*).

It should be noted that the male lectotype and female paralectotype of *A. albanica* that are figured by H. Reiss in Seitz Supplement (1930) are darker and have more opaque hindwings than the other paralectotypes. This may be connected with different conditions of storage of these specimens (humidity?).

There is one more *Adscita* (*Adscita*) species with a praebursa in the female genitalia, viz. *A. mauretanica* (Naufock, 1932), which is restricted to North Africa. In the female genitalia of *A. mauretanica* the praebursa is spherical or ovoid with inner sclerotized dentations and a ventral pocket-like evagination; the distal part of the ductus bursae arises from the proximal part of the praebursa (Efetov, 2001*b*: pl. 32, fig. 12). In *A. dujardini* the praebursa is not spherical or ovoid, lacks the inner sclerotized dentations and ventral pocket-like evagination; the distal part of the ductus bursae is a prolongation of the distal part of the praebursa (Fig. 26). In the male genitalia of *A. mauretanica* the valva is long and



Figs 26, 27. *Adscita* spp., female genitalia. 26, *A. dujardini* sp. nov., paratype, Italy, Macerata, Monte San Vicino, 14.vi.2012 (*G. M. Tarmann*) (gen. prep. Z 3609). 27, *A. albanica* (Naufock, 1926), Crimea, Kurlyuk-Bash, 21.vi.1996 (*K. A. Efetov*) (gen. prep. Z 3884).

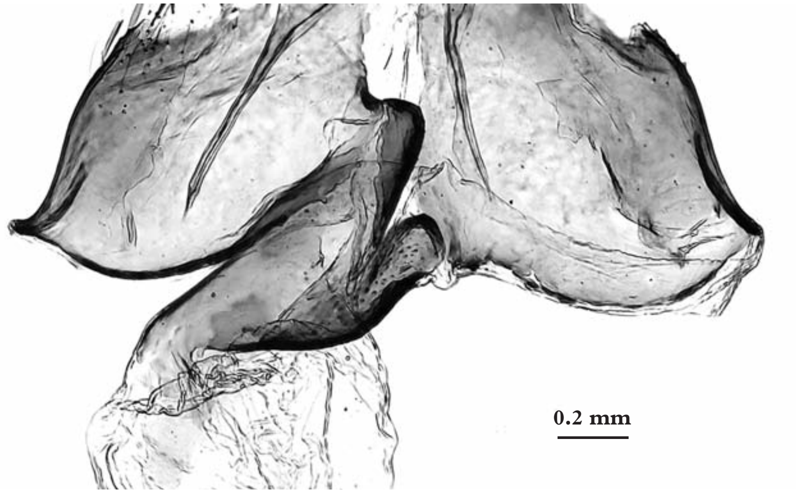
slender, lacks the process at the apex of the sacculus; the aedeagus is short with two curved cornuti (Efetov, 2001*b*: pl. 9, fig. 12). In *A. dujardini* the valva is broad, with a pointed process at the apex of the sacculus; the aedeagus is long, with one straight cornutus (Figs 18, 20–22).

Adscita dujardini can be easily distinguished from all other *Adscita* species by the very different structure of the genitalia (see key).

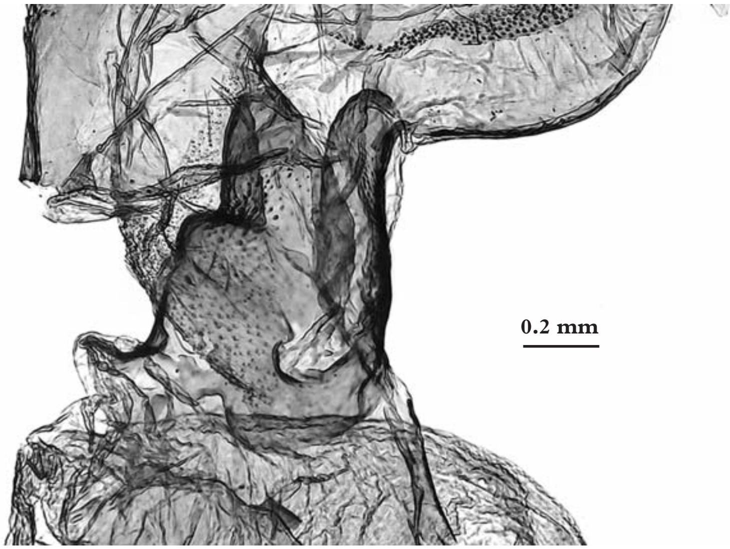
Comparison of the distribution of *Adscita dujardini* sp. nov. and *A. albanica* (Naufock, 1926) (Map 1)

Adscita dujardini sp. nov.
South-eastern France (Alpes Maritimes) (Billi & Varenne, 1996), Switzerland (Valais) (Sauter & de Bros, 1959; Sauter, 1965; Guenin, 1997), Italy (Italian Alps: Val Susa, southern Alps from Val Camonica/Val Cortino to Mte Grappa, Karst near Trieste; Appennines from Liguria to Calabria) (Agenjo, 1940; Bertaccini & Fiumi, 1999; Drouet & Tarmann, 1989; Efetov & Tarmann, 1999; Efetov, 2004; Gross, 1965) and Slovenia (Trnovo region) (Daniel, 1960).

Adscita albanica (Naufock, 1926)
Balkans: Albania (Naufock, 1926), Macedonia (Daniel, Forster & Osthelder, 1951; Daniel, 1964); Greece (Coutsis, 1979), Bulgaria (Efetov, [1999*b*]); Ukraine: Kiev Region, Zhitomir Region, Cherkassy Region; Crimea; Russia: Northern Caucasus (Stavropol Territory) and Volga Basin (Ulyanovsk Region, Penza Region, Samara Region, Saratov Region, west of Orenburg Region) (Efetov, 1990*b*; 1994; 1998*a*; 1998*b*; [1999*a*]; 2001*b*; 2004; 2005, 2008; Efetov & Tarmann, 1999; Bolshakov, Polumordvinov & Shibaev, 2010).



28



29

Figs 28, 29. *Adscita* spp., female genitalia, antrum region, larger magnification. 28, *A. dujardini* sp. nov., paratype, Italy, Verona, Monte, 25.vi.1987 (*G. M. Tarmann*) (gen. prep. Z 2304). 27, *A. albanica* (Naufock, 1926), Albania, Pashtrik, 4–14.vii.1918 (*H. Zerny & K. Predota*) (gen. prep. Z 3852).

Historical note

In the original description of *Procris albanica*, Naufock (1926) had already mentioned that the habitus of this species differs from *Procris statices* (Linnaeus, 1758) and *Procris mannii* (Lederer, 1853) by its more yellowish green forewings. He also wrote that the density of the scales is not so strong as in *P. mannii* but similar to that of *P. statices*. Regarding the hindwings of *P. albanica*, he stated that they are slightly transparent as in *P. statices*, in colour more brownish but not as dark and opaque as in *P. mannii*. This is a good comparative description of the habitus of *Adscita albanica* (Figs 3, 12–14).

Daniel (1960) published on two male specimens of *A. albanica* from 'Ternovaner Wald' in Slovenia. Like Naufock (1926) he also compares the habitus of these two specimens with that of *A. statices* and arrives at a different description. He mentioned that his specimens were more densely scaled, with a stronger green metallic sheen and darker hindwings than in *A. statices*. Moreover, he also stated that his specimens are very similar in habitus to *A. mannii* and have shorter and apically more rounded forewings than *A. albanica* from Albania and Macedonia. This is already a first reasonable description of the habitus of *Adscita dujardini* sp. nov. Of course, Daniel did not realise that he had a different species. Alberti had determined these two specimens as '*Procris albanica*' by brushing off the scales from the underside of the abdomens.

Based on specimens collected in 1967, 1968 and 1969 by C. Dufay and F. Hartig in Monte Vulture, Italy, F. Dujardin, had intended to describe this population as a new subspecies of *Procris albanica*. This is visible from the original labels of Dujardin on specimens in his collection (now deposited in TLMF, Innsbruck, Austria) and is also confirmed by Dujardin's unpublished handwritten manuscript (deposited with E. Drouet, pers. comm.). At that time the biology of *Adscita albanica* was unknown.

On 17 June 1989, K. A. Efetov observed for the first time the oviposition of a female of *A. albanica* on *Geranium sanguineum* in the Crimea and reared specimens ab ovo (Efetov, 1990*a*; 1990*b*; 1992). This was the first record on Geraniaceae as a larval host-plant for species of Procridinae. Later (10–12 September 1993), information about the early stages of this species was presented in a lecture at the V International Symposium on the Biology of the Zygaenidae in Grietherbusch (Germany) and published in the abstracts of this symposium (Efetov, 1993). A more detailed paper was delivered to the editorial board of the *Proceedings* of the Grietherbusch Symposium in 1993. Already in 1990, before these publications, K. A. Efetov had informed G. M. Tarmann that *Geranium sanguineum* was a larval host-plant of *A. albanica*. This stimulated the latter author to search the known localities of '*A. albanica*' in northern Italy and he was able to confirm such information. In 1992, he and W. G. Tremewan also observed ovipositing females and GMT was able to rear the species ab ovo. *Geranium sanguineum* as a larval host-plant was also mentioned for '*A. albanica*' populations in France (Billi & Varenne, 1996) and a description of the early stages was published by Guenin (1997). The publication of the *Proceedings* of the Grietherbusch Symposium was delayed for several years by C. M. Naumann (editor in chief). The book did not appear until 1999 (the date on the cover of the book is erroneously cited as 1998). C. M. Naumann added the following note to the paper of K. A. Efetov: 'While this paper was in press, the early instars of *Adscita* (*Adscita*) *albanica* (Naufock, 1926) have been described by Guenin (1997)' (Efetov, [1999*b*]). However, with our contemporary knowledge, we can summarize that the first description of the early instars of *A. albanica* was provided by K. A. Efetov (1993; [1999*b*]), while that of *A. dujardini* was provided by R. Guenin (1997). The biology of and detailed information on the early stages of *A. albanica* were also published by Efetov & Tarmann (1999).

Naumann, Tarmann & Tremewan (1999) mentioned under 'geographic variation' the variability in the habitus of '*A. albanica*' between eastern and western populations and stated that specimens from the Alps and Apennines are darker than those from the Balkans and the Caucasus. They also figured a

Fig. 30. Francis Dujardin (1910–1984).

western and an eastern male (pl. 2, figs 1, 2). However, the specimen illustrated in fig. 1 was later determined by dissection as *A. mannii* (from a locality where it is syntopic with *A. albanica*) and the shown difference in colour is therefore incorrect, although specimens of both species from that locality (Pregasina, Italy) are indistinguishable in habitus. The scales of the abdomen of the above-mentioned specimen illustrated on pl. 2, fig. 1 were brushed off but a portion at the end of the abdomen were glued together to form a process-like structure, thus causing the misidentification. All other specimens taken on the same day at the same place were dissected and are *A. dujardini*. At that time there was a common consensus that the unique genitalia type (long process of apex of valva that is visible by brushing of the scales, large cornutus) made the determination to appear easy in the males and therefore dissections were not always considered to be necessary. The small number of available specimens of the western populations also prevented examination of a series of genitalia. Moreover, as the western populations have the same larval host-plant as the eastern and the imagines have similar behaviour (e.g. feeding from the underside of the flowers of *Geranium sanguineum* with the proboscis between the petals (Efetov, [1999*b*]: 270, fig. 8)), the idea that there were two species was not obvious. Nevertheless, according to the published photos in Guenin (1997: 412, fig. 1; 413, fig. 3), Efetov ([1999*b*]: 276, fig 1; 2001*b*: 261, pl. 56, fig. 8; 2005: 269, pl. 19, fig. 6) and Efetov & Tarmann (1999: 159, fig. 363), the coloration of the larvae is completely different. However, a strong variability in larval coloration is also known in other *Adscita* species (e.g. in *A. mannii* from southern Italy where the colour of the dorsal verrucae in larvae reared ab ovo from one and the same egg cluster varies from white to yellow and dark brown). Therefore the larval difference between 'western and eastern populations of *A. albanica*' was not taken in account.

In 2013, DNA barcoding of specimens of both populations showed a significant difference (Fig. 1) that induced us to study the morphology more carefully. The habitus of all type specimens of *A. albanica* and of many specimens from the whole range of the distribution were studied and their genitalia dissected and compared. As a result constant differences in characters were found between *A. albanica* (Naufock, 1926) and *A. dujardini* sp. nov.

An updated key to the western Palaearctic subgenera and species of the genus *Adscita* Retzius, 1783

Key to subgenera

1 Male (antenna bipectinate; frenulum represented by one bristle, retinaculum formed of a sclerotized curved process situated at base of vein Sc) 2
– Female (antenna biserrate; frenulum represented by more than one bristle, retinaculum formed of specialized scales situated near base of vein CuP) 3

Male

2 Distal end of aedeagus funnel-shaped (1.5–2.0 times broader than narrowest part of aedeagus), with longitudinal folds and covered with very small spines; cornutus weakly sclerotized .... subgenus ***Tarmannita*** Efetov, 2000 (2 species)
– Distal end of aedeagus not funnel-shaped, or without longitudinal folds and small spines if slightly dilated; cornutus (if present) strongly sclerotized .... subgenus ***Adscita*** Retzius, 1783 (12 species)

Female

3 Ductus bursae with small lateral appendix .... subgenus ***Tarmannita*** Efetov, 2000 (2 species)
– Ductus bursae without small lateral appendix .... subgenus ***Adscita*** Retzius, 1783 (12 species)

Key to the species of the subgenus *Tarmannita* Efetov, 2000

Male

1 Cornutus longer than half length of aedeagus (only in Iberian Peninsula) .... ***A.* (*T.*) *bolivari*** (Agenjo, 1937)
– Cornutus shorter than half length of aedeagus (not only in Iberian Peninsula – from north-eastern Spain through southern Europe to north-western Turkey) .... ***A.* (*T.*) *mannii*** (Lederer, 1853)

Female

1 Corpus bursae rounded or ovoid (only in Iberian Peninsula) .... ***A.* (*T.*) *bolivari*** (Agenjo, 1937)
– Corpus bursae heart-shaped (not only in Iberian Peninsula – from north-eastern Spain through southern Europe to north-western Turkey) .... ***A.* (*T.*) *mannii*** (Lederer, 1853)

Key to the species of the subgenus *Adscita* Retzius, 1783

Male

1 Ventral margin of sacculus with pointed hook-shaped process .... ***A.* (*A.*) *jordani*** (Naufock, 1921)

– Ventral margin of sacculus without process (sometimes with a process at apex of sacculus) 2

2 Aedeagus with one cornutus, or without cornuti 3
– Aedeagus with two cornuti 10

3 Cornutus more than two-thirds length of aedeagus 4
– Cornutus two-thirds length of aedeagus or less, or even absent 5

4 Apex of sacculus pointed, forming triangular process; cornutus broad (ratio of length to maximum breadth less than 10) .... ***A.* (*A.*) *albanica*** (Naufock, 1926)
– Apex of sacculus rounded, not forming any process; cornutus narrow (ratio of length to maximum breadth more than 20) .... ***A.* (*A.*) *obscura*** (Zeller, 1847)

5 Cornutus from half to two-thirds length of aedeagus 6
– Cornutus significantly shorter than half length of aedeagus, or absent 9

6 Apex of sacculus pointed 7
– Apex of sacculus rounded 8

7 Apex of sacculus not forming long process; cornutus narrow (ratio of length to maximum breadth more than 20) (Crimean Peninsula) .... ***A.* (*A.*) *krymensis*** Efetov, 1994
– Apex of sacculus forming long process; cornutus broader (ratio of length to maximum breadth less than 15) (Italy, south-eastern France, Switzerland (Valais) and western Slovenia) .... ***A.* (*A.*) *dujardini*** sp. nov.

8 Cornutus curved, aperture of cornutus funnel-shaped (widely distributed in Europe and Asia, but absent in southern parts of Balkan Peninsula and in Turkey) .... ***A.* (*A.*) *statices statices*** (Linnaeus, 1758)
– Cornutus straight, aperture of cornutus dish-shaped (southern parts of Balkan Peninsula and in Turkey) .... ***A.* (*A.*) *statices drenowskii*** (Alberti, 1939)

9 Club of antenna broad (ratio of breadth of segment 4 to breadth of segment 15, counting from apex of antenna, more than 2); apex of sacculus rounded .... ***A.* (*A.*) *capitalis*** (Staudinger, 1879)
– Club of antenna narrow (ratio of breadth of segment 4 to breadth of segment 15, counting from apex of antenna, less than 2); apex of sacculus pointed .... ***A.* (*A.*) *geryon*** (Hübner, 1813)

10 Aedeagus broad (less than 4 times longer than broad); both cornuti strongly curved and equal in length (as long as uncus) (Morocco, western Algeria) .... ***A.* (*A.*) *mauretanica*** (Naufock, 1932)
– Aedeagus narrow (more than 5 times longer than broad); at least one cornutus straight and significantly shorter than uncus (absent in North Africa) 11

11 Proximal cornutus nearly 10 times longer than distal one 14
– Proximal cornutus only up to 3 times longer than distal one, or both cornuti equal in length 12

12 Both cornuti nearly equal in length (Iberian Peninsula) .... ***A.* (*A.*) *schmidti*** (Naufock, 1933)
– Proximal cornutus longer than distal one (Alps, Italy, Turkey) 13

13 Wings lighter, more translucent. Proximal cornutus of aedeagus more than 2 times longer than distal one, aperture of proximal cornutus more or less funnel-shaped (restricted to the Alps: south-eastern France, southern and south-eastern Switzerland, western Austria, northern Italy) .... ***A.* (*A.*) *alpina*** (Alberti, 1937)
– Wings darker, less translucent. Proximal cornutus of aedeagus only 2 times longer (or less) than distal one, aperture of proximal cornutus more or less dish-shaped (central and southern Italy and eastern Turkey) .... ***A.* (*A.*) *italica*** (Alberti, 1937)

14 Long cornutus curved, aperture of cornutus funnel-shaped (widely distributed in Europe and Asia, but absent in southern parts of Balkan Peninsula and in Turkey) ....***A.* (*A.*) *statices statices*** (Linnaeus, 1758)
– Long cornutus straight, aperture of cornutus dish-shaped (southern parts of Balkan Peninsula and in Turkey) .... ***A.* (*A.*) *statices drenowskii*** (Alberti, 1939)

Female

(the female of *A.* (*A.*) *krymensis* Efetov, 1994, is unknown)

1 Caudal part of ductus bursae strongly dilated, forming a praebursa 2
– Caudal part of ductus bursae not forming a praebursa 4

2 Praebursa spherical or ovoid with inner sclerotized dentations and ventral pocket-like evagination; distal part of ductus bursae arising from proximal part of praebursa (Morocco, western Algeria) .... ***A.* (*A.*) *mauretanica*** (Naufock, 1932)
– Praebursa irregular in shape, without inner sclerotized dentations and pocket-like evagination; distal part of ductus bursae a prolongation of distal end of praebursa 3

3 Antrum pot-shaped, length of praebursa equal to or larger than its breadth, proximal part of praebursa with dorsal sclerotization (southern Balkans, eastern Europe, Northern Caucasus) .... ***A.* (*A.*) *albanica*** (Naufock, 1926)
– Antrum funnel-shaped, length of praebursa less than its breadth, proximal part of praebursa without dorsal sclerotization (Italy, south-eastern France, Switzerland (Valais) and western Slovenia) .... ***A.* (*A.*) *dujardini*** sp. nov.

4 Corpus bursae double 5
– Corpus bursae single 6

5 Ductus bursae heavily sclerotized only near ostium (less than one-fifth length of ductus bursae), without lateral evagination (widely distributed in Europe and Asia, but absent in central and southern Italy and eastern Turkey) .... ***A.* (*A.*) *statices*** (Linnaeus, 1758)
– Caudal part of ductus bursae heavily sclerotized throughout (more than two-thirds length of ductus bursae), with lateral evagination (central and southern Italy and eastern Turkey) .... ***A.* (*A.*) *italica*** (Alberti, 1937)

6 Ductus bursae very long (more than 30 times longer than breadth of medial part of ductus bursae, more than 6 times longer than diameter of corpus bursae) .... ***A.* (*A.*) *obscura*** (Zeller, 1847)
– Ductus bursae shorter (less than 25 times longer than breadth of medial part of ductus bursae, less than 4 times longer than diameter of corpus bursae) 7

7 Ductus bursae with lateral evagination 8
– Ductus bursae without lateral evagination 9

8 Lateral evagination of ductus bursae represented by a rectangular pocket, situated approximately at one-half length of ductus bursae (Iberian Peninsula) .... ***A.* (*A.*) *schmidti*** (Naufock, 1933)
– Lateral evagination of ductus bursae represented by an ovoid pocket situated at one-quarter to one-third length of ductus bursae, closer to ostium (Alps: south-eastern France, southern and south-eastern Switzerland, western Austria, northern Italy) .... ***A.* (*A.*) *alpina*** (Alberti, 1937)

9 Caudal two-thirds of ductus bursae not heavily sclerotized, with folded walls (only in Iberian Peninsula) .... ***A.* (*A.*) *jordani*** (Naufock, 1921)
– Caudal two-thirds of ductus bursae heavily sclerotized, with smooth walls (not restricted to Iberian Peninsula) 10

10 Club of antenna broad (ratio of breadth of segment 4 to breadth of segment 15, counting from apex of antenna, more than 2) .... ***A.* (*A.*) *capitalis*** (Staudinger, 1879)
– Club of antenna narrow (ratio of breadth of segment 4 to breadth of segment 15, counting from apex of antenna, less than 2) .... ***A.* (*A.*) *geryon*** (Hübner, 1813)

Remark. In the Alps there are specimens that have characters intermediate between *A.* (*A.*) *alpina* and *A.* (*A.*) *statices*; they probably represent hybrids of these two species.

Acknowledgements

We are indebted to Dr Sabine Gaal (Naturhistorsiches Museum Wien, Austria) for the loan of the type specimens of *Procris albanica* Naufock, Professor Dr P. D. N. Hebert (Canada), Dr R. Rougerie (France), Mrs E. V. Parshkova, Mrs Z. S. Lazareva and Mrs Anna V. Kirsanova (Crimea) for help in molecular investigation. We also thank Mr E. Drouet (France), Professor Dr V. V. Anikin, Mr O. A. Polumordvinov, Professor Dr S. A. Sachkov and Dr V. V. Zolotuhin (Russia) for loan or donation of material. Mr R. Guenin (Switzerland) and Mr W. Wagner (Germany) are thanked for supplying us with photos and fruitful discussion. We thank Dr V. L. Saenko and Mr P. V. Ruchko (Crimea) for help in the preparation of the line drawings. Mr S. Heim and Mr H. Kühtreiber (Tiroler Landesmuseen, Ferdinandeum, Innsbruck, Austria) are thanked for the photography and for compiling the distribution map respectively. We also are indebted to Mr E. Drouet for supplying us with a photograph of the late Francis Dujardin. For various help we thank Mrs G. Fuchs (Austria). Last but not least we thank Dr W. G. Tremewan (Great Britain) for his kind support.

References

Agenjo, R. 1940. Los *Procris* no españoles del Museo de Madrid (Lep. Zygaen.). *Eos, Madrid* **13** (1937): 45–116, pls 2–8.

Alberti, B. 1954. Über die stammesgeschichtliche Gliederung der Zygaenidae nebst Revision einiger Gruppen (Insecta, Lepidoptera). *Mitteilungen aus dem Zoologischen Museum der Humboldt-Universität Berlin* **30**: 115–480, pls 1–62.

——— 1971. Zur Kenntnis der Zygaeniden-Fauna des Großen Kaukasus und Transkaukasiens (Lepidoptera, Zygaenidae). *Faunistische Abhandlungen Staatliches Museum für Naturkunde in Dresden* **3**: 50–81, 1 map, 1 text-fig., 1 pl.

Bertaccini, E. & Fiumi, G. 1999. *Bombici e Sfingi d'Italia* (*Lepidoptera Zygaenidae*) **3**: 160 pp., 13 pls, text-figs, distr. maps. Monterenzio.

Billi, F. & Varenne, T. 1996. Les Lépidoptères du Vallon de Saint-Colomban (Lantosque, Alpes-Maritimes). Première localité française d'*Adscita albanica* Naufock. *Riviéra Scientifique* **80**: 47–52, 3 figs.

Bolshakov, L. V., Polumordvinov, O. A. & Shibaev, S. V. 2010. Forester and burnet moths (Lepidoptera: Zygaenidae) of Penza Region. *Caucasian entomological Bulletin* **6** (2): 179–184, fig. 1.

Coutsis, J. G. 1979. *Adscita albanica* (Naufock) from Greece and new insular records of *A. obscura* (Zeller) and *A. subsolana* (Staudinger) (Lepidoptera: Zygaenidae). *Entomologist's Gazette* **30**: 125–126, fig. 1.

Daniel, F. 1960. Eine für das Alpengebiet neue *Procris*-Art: *P. albanica* Nauf. (Lep. Zygaenidae). *Nachrichtenblatt der Bayerischen Entomologen* **9**: 57–58.

——— 1964. *Die Lepidopterenfauna Jugoslavisch Mazedoniens.* II. Bombyces et Sphinges. 75 pp., 4 figs. Skopje.

Daniel F., Forster W. & Osthelder, L. 1951. Beiträge zur Lepidopterenfauna Mazedoniens. *Veröffentlichungen der Zoologischen Staatssammlung München* **2**: 1–78, 2 pls.

Drouet, E. & Tarmann, G. M. 1989. Données nouvelles pour la réparation de quelques Adscita Retzius en France et en Italie (Lep. Zygaenidae). *Linneana belgica* **12**: 34–42, 1 fig.

Efetov, K. A. 1990*a*. Family Zygaenidae, pp. 84–85. *In* Efetov, K. A. & Budashkin, Yu. I., *Lepidoptera of the Crimea* 112 pp., 40 col. pls. Simferopol.

——— 1990*b*. Comparative analysis of the Zygaenidae (Lepidoptera) fauna of the Crimea and the Caucasus, pp. 160–161. *In*: *Advances of Entomology in the USSR: Insects Hymenoptera and Lepidoptera.* Leningrad.

——— 1992. On the biology and taxonomy of the genus *Adscita* Retzius, 1783 (Zygaenidae). *Abstracts of the 8th European Congress of Lepidopterology, Helsinki, Finland, April 1992*: 9. Helsinki.

——— 1993. On the biology of *Adscita albanica* (Naufock, 1926) (Zygaenidae). *Abstracts of the 5th International Symposium on the Biology of the Zygaenidae* (*Insecta, Lepidoptera*), *Grietherbusch* (*Germany*), *10–12 September 1993*: 2. Köln.

——— 1994. *Adscita* (*Adscita*) *krymensis* sp. n. from the Crimea (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **45**: 267–271, figs 1–7.

——— 1998*a*. A review of the fauna of the Zygaenidae (Lepidoptera) of the Volga region: I. Subfamily Procridinae, pp. 148–149. *In*: *Problems of Entomology in Russia.* **1**. St. Petersburg.

——— 1998*b*. The fauna of the Zygaenidae (Lepidoptera) of the Volga region, pp. 58–60. *In*: *Problems of Entomology of European Part of Russia and Adjacent Territories.* Samara.

——— [1999*a*]. A check-list of the Zygaenidae (Lepidoptera) of the former U.S.S.R., pp. 229–243, map. *In* Tremewan, W. G., Wipking, W. & Naumann, C. M. (Eds), Proceedings of the 5th International

Symposium on the biology of the Zygaenidae (Insecta, Lepidoptera), Grietherbusch, 10–12 September 1993. *Theses zoologicae* **30** (1998): 289 pp.

——— [1999*b*]. Description of the early stages of *Adscita* (*Adscita*) *albanica* (Naufock, 1926) (Lepidoptera: Zygaenidae), pp. 265–271, 9 figs. *In* Tremewan, W. G., Wipking, W. & Naumann, C. M. (Eds), Proceedings of the 5th International Symposium on the biology of the Zygaenidae (Insecta, Lepidoptera), Grietherbusch, 10–12 September 1993. *Theses zoologicae* **30** (1998): 289 pp.

——— 2001*a*. An annotated check-list of Forester moths (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **52**: 153–162, figs 1–5.

——— 2001*b*. *A Review of the Western Palaearctic Procridinae* (*Lepidoptera: Zygaenidae*) 328 pp., col. frontispiece, 98 text–figs, 44 monochrome, 29 col. pls. Simferopol.

——— 2004. *Forester and Burnet moths* (*Lepidoptera: Zygaenidae*). The genera *Theresimima* Strand, 1917, *Rhagades* Wallengren, 1863, *Zygaenoprocris* Hampson, 1900, *Adscita* Retzius, 1783, *Jordanita* Verity, 1946 (Procridinae), and *Zygaena* Fabricius, 1775 (Zygaeninae) 272 pp., col. frontispiece, 183 figs, 1 col. pl. Simferopol.

——— 2005. *The Zygaenidae* (*Lepidoptera*) *of the Crimea and other regions of Eurasia* 420 pp., col. frontispiece, 78 figs, 27 monochrome, 32 col. pls, distr. maps. Simferopol.

——— 2008. Zygaenidae, pp. 107–109, 329. *In* Sinev, S. Yu. (Ed.), *Catalogue of the Lepidoptera of Russia* 424 pp. St. Petersburg & Moscow.

Efetov, K. A., Keil, T., Mollet, B. & Tarmann, G. M. 2000. New data on the chaetotaxy of the first instar larva of Forester moths (Lepidoptera: Zygaenidae, Procridinae). *Nachrichten des entomologischen Vereins Apollo* (N.F.) **21**: 83–90, figs 1–34.

Efetov, K. A. & Tarmann, G. M. 1995. An annotated check-list of the Palaearctic Procridinae (Lepidoptera: Zygaenidae), with descriptions of new taxa. *Entomologist's Gazette* **46**: 63–103, figs 1–23.

——— 1999. *Forester Moths*: The genera *Theresimima* Strand, 1917, *Rhagades* Wallengren, 1863, *Jordanita* Verity, 1946, and *Adscita* Retzius, 1783 (Lepidoptera: Zygaenidae, Procridinae) 192 pp., 415 figs, 12 col. pls. Stenstrup.

Efetov, K. A., Tarmann, G. M., Hayashi, E. & Parshkova, E. V. 2006. New data on the chaetotaxy of the first instar larvae of Procridini and Artonini (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **57**: 229–233, figs 1–7.

Freina, J. J. de & Witt, T. J. 2002. Die Bombyces und Sphinges der Westpalaearktis (Insecta, Lepidoptera) **3** Zygaenoidea: Zygaenidae 575 pp., 85 text-figs, col. frontispiece, 62 col. pls, 116 distr. maps. München.

Guenin, R. 1997. Zygaenidae – Rot- und Grünwidderchen, pp. 313–430, figs. In Pro Natura – Schweizerischer Bund für Naturschutz (Ed.), *Schmetterlinge und ihre Lebensräume*. Arten, Gefährdung, Schutz. **2**: xi, 679 pp. Basel.

Gross, F. J. 1965. Über die Zygaenidae der Gattung *Procris* aus den Abruzzen (Lep.). *Entomologische Zeitschrift* **76**: 54–55.

Naufock, A. 1926. *Procris albanica* n. sp. *Verhandlungen der Zoologisch-botanischen Gesellschaft Wien* **74**/**75** (1924/1925): (126)–(129), figs 2, 3.

Naumann C. M., Tarmann, G. M. & Tremewan, W. G. 1999. *The Western Palaearctic Zygaenidae* (*Lepidoptera*) 304 pp., 178 figs, 12 col. pls. Stenstrup.

Reiss, H. 1930–1933. 1. Familie: Zygaenidae, Widderchen, pp. 1–50, pls 1–4 (1930–1931); pp. 249–278, pl. 16 (1933). *In* Seitz, A., 1930–1934, *Die Gross-Schmetterlinge der Erde*, Supplement **2**: vii, 315 pp., 16 pls. Stuttgart.

Sauter, W. 1965. Zur Verbreitung der *Procris*-Arten der Schweiz, p. 226. *In* Vogel, W., Protokoll der Jahresversammlung der Schweizerischen Entomologischen Gesellschaft vom 15. März 1964 in Bern. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* **37**: 222–227.

Sauter, W. & de Bros, E. 1959. Note sur la faune des Lépidoptères de Zeneggen. *Bulletin de la Murithienne, Société valaisanne des sciences naturelles* **76**: 107–129.