

## Contribution to the fauna of *Elasmus* Westwood (Hymenoptera: Eulophidae) in Bulgaria

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**Abstract.** Twelve species of genus *Elasmus* Westwood are presented; eleven of them are new records for Bulgaria. Bulgaria is the second country where *Elasmus bistrigatus* Graham, 1995 and *E. longiclava* Graham, 1995 were collected.

**Key words:** Hymenoptera, Eulophidae, *Elasmus*, Bulgaria.

### Introduction

The genus *Elasmus* is the only member of the tribe Elasmini (Eulophidae, Eulophinae), formerly classified as a separate family Elasmidae (Gauthier *et al.* 2002). The genus contains over 227 species worldwide (Noyes 2009). They are mostly parasitoids or hyperparasitoids of lepidopteran or hymenopteran larvae. Until now only one species of genus *Elasmus* were known to occur in Bulgaria – *Elasmus unicolor* (Rondani 1877) (Ferrière 1947, Herting 1975, Trjapitzin 1978, Noyes 2009).

### Materials and methods

This paper is based on 109 specimens collected from 29 localities in Bulgaria by A. Germanov, A. Donev, S. Petrov, T. Ivanova, N. Popova, A. Stojanova, H. Eturska, M. Antov and P. Boyadzhiev during the period 1968, 1982, 1995-2009. For collecting the material the following methods was used: sweeping, yellow traps, Malaise traps and screen-sweeping.

Morphological terminology follows that of Graham (1976, 1995). The abbreviations used in the text listed below: F1-F4 – first to fourth segments of antennal funicle; SMV – submarginal vein; MV – marginal vein; PMV – postmarginal vein; SV – stigmal vein; POL – the minimum distance between the posterior ocelli; OOL – the minimum distance between the eye margin and the adjacent posterior ocellus; OD – the longest diameter of an ocellus. Relative measurements are used for all dimensions.

The material is deposited in the collection of the Department of Zoology, University of Plovdiv, Bulgaria (DZUP) and in the collection of Zoological Institution, Russian Academy of Sciences, St. Petersburg, Russia (ZISP).

## Results

### Genus *Elasmus* Westwood, 1833

*Elasmus* Westwood, 1833: 343.

*Eulophus flabellatus* Fonscolombe, 1832: 298 [Type species by monotypy].

**Diagnosis.** Fore wing densely setose and wedge-shaped, with elongate marginal vein, short postmarginal, and slightly reduced stigmal; female funicle 3-segmented, male funicle 4-segmented; mesosoma densely setose, metasoma sessile; and gaster triangular in cross. Metanotum projecting as flat, triangular, often translucent plate over propodeum. Dorsal metanotal lamella projecting posterior over propodeum with partial and complete lateronventral keels. Metacoxa greatly enlarged and flattened plate-like hind tibia with short bristles forming distinct diamond-shaped or undulating pattern.

**Biology.** Polyphagous attacking several genera of Coleophoridae, Gracillariidae, Tortricidae, Pyralidae, Psychidae, Noctuidae, Coccidae, Ypoomeutidae (Lepidoptera), Braconidae, Bethyidae, Chalcididae, Ichneumonidae, Vespidae (Hymenoptera), Chrysomelidae, (Coleoptera) (Graham 1976, 1995; Noyes 2009).

**Distribution.** Afrotropical, Australia/Pacific, Nearctic, Neotropical, Oriental and Palearctic Regions.

**Identification.** The European species are keyed by Graham (1976, 1995) and Ferrière (1947). It is very difficult to identify males of *Elasmus* especially if they were sweeping and not rearing together with females.

### *Elasmus bicolor* (Fonscolombe, 1840)

*Eulophus bicolor* Fonscolombe, 1840: 190.

*Elasmus bicolor* Graham, 1976: 294-295.

**Diagnosis.** Female: forewing with two fuscous clouds: in the basal quarter and large just beyond the middle. Antenna, F1 slightly longer than pedicel, F3 1.8-2.0 times as long as broad. Dorsellum yellow, body marked with reddish-yellow.

**Hosts.** *Paramictoides febrella* (Fonscolombe) (Lepidoptera: Psychidae) (Graham 1995).

**Distribution.** Palearctic: Europe (France, Cyprus) (Graham 1995).

**Material examined:** 6 ♀♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 250 m, 1.VII.2000 (A. Stojanova); 3 ♀♀, Bulgaria, Rhodope Mts., Novo Selo Vill. 200 m, 24.VII.2000 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 17.V.2001 (A. Stojanova) (DZUP, ZISP).

### *Elasmus bistrigatus* Graham, 1995

*Elasmus bistrigatus* Graham, 1995: 15-16.

**Diagnosis.** Female: F1 1.5 times as long as F2, clava 3.0 times as long as F3, head extensively yellow with dark marks. Dorsellum yellow. T1-T4 of gaster banded with reddish-yellow.

**Hosts.** Unknown.

**Distribution.** Palearctic: Europe (France) (Graham 1995).

**Material examined:** 1 ♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 17.V.2001 (A. Stojanova) (DZUP).

### *Elasmus flabellatus* (Fonscolombe, 1832)

*Eulophus flabellatus* Fonscolombe, 1832: 298.

*Elasmus flabellatus* (Fonscolombe): Westwood, 1833: 343.

*Elasmus flabellatus* – Graham, 1995: 18.

**Diagnosis.** Female: POL 2.0-2.6 OOL, antennal final segment 1.25 times as long as broad, pedicel slightly shorter than or as long as F1, F3 2.0 times as long as broad; forewing

slightly infumate and without isolate cubital and subcubital lines. Male: POL 2.4-2.6 OOL, body black, dorsellum with yellow lamella.

Hosts. Larval-pupal parasitoid of Gelechiidae, Tortricidae, Noctuidae, Yponomeutidae, Heliozelidae, Platellidae, Psychidae, Pyralidae (*Etilia zinckenella*) (Lepidoptera) or hyperparasitoid of Bethyridae, Braconidae, Cephidae, Ichneumonidae (Hymenoptera) (Herting 1975, 1977; Thompson 1954, Trjapitzin 1978).

Distribution. Palearctic: Europe (France, Greece, Germany, Hungary, Italy, Morocco, Romania, Russia, Spain, Sweden, United Kingdom, Yugoslavia) (Thompson 1954, Herting 1975, Trjapitzin 1978, Graham 1995).

Material examined: 1 ♀, Bulgaria, Rhodope Mts., Odnyanovo Vill., 300 m, 2.V.1998 (P. Boyadzhiev); 1 ♀, Bulgaria, Strandzha Mt., Varovnik Vill., 300 m, 29.IX.1999 (P. Boyadzhiev); 1 ♀, Bulgaria, Strandzha Mt., Reserve Silkosiya, near Kosti Vill., 100 m, 7.VII.2000 (A. Stojanova); 1 ♂, Bulgaria, Rhodopi Mts., 2 km SW of Novo Selo Vill., 200 m, 24.VII.2000, (A. Stojanova); 1 ♂, Bulgaria, Rhodopi Mts., v. Surnitsa, 28.VII.2000, (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Byaga Vill., 300 m, 1.VIII.2000 (A. Stojanova); 1 ♀, Bulgaria, Arda Valley, Madzharovo, 200 m, Malaise trap, 26.IX-14.X.2000 (H. Eturska); 1 ♀, Bulgaria, Arda, Valley, Madzharovo, 200 m, Malaise trap., 9.XII.2000-3.I.2001 (H. Eturska); 1 ♀, Bulgaria, Rhodope Mts., Arda Valley, 2 km NE of Madzharovo Vill., 160 m, Malaise trap, 19-29.IV.2001 (H. Eturska); 1 ♀, Bulgaria, Rhodope Mts., Arda Valley, Madzharovo, 160 m, Malaise trap, 29.IV-20.V.2001 (H. Eturska); 1 ♂, Bulgaria, Rhodopi Mts., 2 km SW of Novo Selo Vill., 200 m, 17.V.2001, (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Plevun Vill., 400 m, Malaise trap, 7-17.VI.2001 (A. Stojanova); 1 ♀, 6 ♂, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 17.VI.2001 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Lednitsata, 1600 m, 19.VII.2001 (A. Stojanova); 1 ♀, Bulgaria, Struma Valley, Kresna Gorge, Kresna rail road station, 260 m, Malaise trap, 17.IV-3.V.2003 (M. Langurov); 1 ♀, Bulgaria, Cherni Lom Valley, 110 m, Malaise trap, 10-27.VII.2004 (T. Ivanova, N. Popova); 1 ♀, Bulgaria, Sakar Mt., 2 km S Yerusalimovo Vill., 150 m, screen sweeping on dry grass community, 22.VII.2008 (P. Boyadzhiev) (DZUP, ZISP).

#### ***Elasmus longiclava* Graham, 1995**

*Elasmus longiclava* Graham, 1995: 11-12.

Diagnosis. Female: antenna: pedicel slightly longer than F1, F3 quadrate, clava as long as whole funicle. Body black, dorsellum yellow. Forewing weakly infumate.

Hosts. Unknown.

Distribution. Palearctic: Europe (France) (Graham 1995).

Material examined: 1 ♀, Bulgaria, Rhodope Mts., Novakovo Vill., 450 m, sweeping on grasslands, 5.IX.2001 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., Dascalovo Vill., 550 m, screen sweeping, 23.VIII.2004 (P. Boyadzhiev) (DZUP, ZISP).

#### ***Elasmus nowickii* Ferrière 1947**

*Elasmus nowickii* Ferrière, 1947: 573.

Diagnosis. Female: antenna, F1 not longer than pedicel and 1.55-1.9 times as long as broad. Gaster much longer than head plus thorax. Head, thorax and gaster yellow or fulvous, legs mainly yellow.

Hosts. Unknown.

Distribution. Palearctic: Europe (France, Yugoslavia) (Graham 1995).

Material examined: 6 ♀♀, Bulgaria, Rhodope Mts., Byaga Vill., 300 m, 1.VIII.2000 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 1.VIII.2000 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Novakovo Vill., 450 m, sweeping on grasslands, 5.IX.2001 (P. Boyadzhiev); 1 ♀, Bulgaria, 3 km W of Sandanski, 195 m, screen sweeping on

grasslands, 06.07.2009; 3 ♀; Bulgaria, Sandanski, 300 m, screen sweeping on grasslands, 07.07.2009 (DZUP, ZISP).

***Elasmus nudus*** (Nees, 1834)

*Aneure nuda* Nees, 1834: 195.

*Elasmus albipennis* Thomson, 1878: 206.

*Elasmus nudus* – Graham, 1995: 9.

Diagnosis. Female: antenna with funicle as long as clava. F3 slightly transverse. Scape 3 times as long as broad. Thorax and dorsellum wholly black. The lamella hyaline.

Host. Larval-pupal parasitoid of Choreutidae, Coleophoridae, Lymantriidae, Pyralidae, Tortricidae, Yponomeutidae, *Simaethis pariana* Cl. (Glyphipterygidae) (Lepidoptera) or hyperparasitoid of Braconidae, Ichneumonidae (Hymenoptera) (Herting 1975, Trjapitzin 1978, Graham 1995).

Distribution. Europe (Great Britain, Finland, Sweden, Germany, France, Italy, Czech Republic, Hungary, Moldova, Poland, Tajikistan, Turkmenistan, Russia) (Herting 1975, Trjapitzin 1978, Graham 1995).

Material examined: 2 ♀♀, Bulgaria, Pirin Mt., 2 km NW of Hadzhidimovo, 700 m, 8.IX.2006 (P. Boyadzhiev) (DZUP, ZISP).

***Elasmus platyedrae*** Ferrière, 1935

*Elasmus platyedrae* Ferrière, 1935: 368.

*Elasmus elongatus* Ferrière, 1947: 579-580.

*Elasmus platyedrae* Ferrière: Bouček, 1977: 120.

Diagnosis. Female: Fore wing with a long wedge-shaped bare strip extending from the base, and with isolated subcubital line of setae. Head and thorax black sometimes with bluish tinge. Metacoxa with short hair. Gaster long and narrow, reddish ventrally in some specimens. Penultimate tergite of gaster 1.2-2.0 times as long as its basal breadth. Antenna: F1 longer than pedicel. Male: POL about 3 times OOL. Body black except for a narrow yellowish lamella on dorsellum.

Hosts. Larval parasitoid of *Pectinophora gossypiella* Saunders, *Pexicopia malvella* (Hubner) (Lepidoptera, Gelechiidae); parasitoid of *Ceroplastes* sp. and CBM = Coffea borer moth (= *Zeurea coffea* Nietner) (Cossidae) (Ferrière 1947, Graham, 1995).

Distribution. Afrotropical, Nearctic, Oriental and Palearctic Regions (Graham 1995).

Material examined: 1 ♀, Bulgaria, Stara Planina Ridge, Jamna Vill., 24.VIII.1968 (A. Germanov); 1 ♀, Bulgaria, Rhodope Mts., Bryanovshtitsa, 1050 m, 17.V.1997 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., Reserve Kormisosh, 1200 m, 4.VII.1997 (A. Stojanova); 3 ♀♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 250 m, 1.VII.2000 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Byaga Vill., 300 m, 1.VIII.2000 (A. Stojanova); 1 ♂, Bulgaria, Arda, Valley, 2 km NE Madzharovo, 160 m, Malaise trap., 1-9.XII.2000, (H. Eturska); 1 ♂, Bulgaria, Prin Mt., Sveti Ilia hill, near Kalimantsi maquis, 475 m, Malaise trap, 9-12.V.2002, (M. Langurov); 1 ♀, Bulgaria, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping on grasslands, 23.VII.2004 (P. Boyadzhiev); 2 ♀♀, Bulgaria, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping, 15.IX.2004 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping on grasslands, 8.X.2004 (P. Boyadzhiev); 1 ♀, Bulgaria, Sakar Mt., Yerasalimovo Vill., 390 m, screen sweeping, 26.IV.2006 (P. Boyadzhiev); 4 ♀♀, Bulgaria, Kurdzhali region, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping on boggy grass community, 4.IX.2006 (P. Boyadzhiev); 1 ♀, Bulgaria, Pirin Mt., 2 km W of Hadrhidimovo, 499 m, screen sweeping, 8.IX.2006 (P. Boyadzhiev); 3 ♀♀, Bulgaria, Sakar Mt., Jerusalemovo Vill., 90 m, screen sweeping on boggy grass community,

21.VIII.2008 (P. Boyadzhiev); 1 ♀, Bulgaria, Kjustendil, Gereha District, 575 m, screen sweeping, 22.VIII.2008 (M. Antov) (DZUP, ZISP).

***Elasmus rufiventris* Ferrière, 1947**

*Elasmus rufiventris* Ferrière, 1947: 576.

Diagnosis. POL 3.0-3.5 OOL; OOL 1.5-1.6 OD; F1 not longer than pedicel. Gaster with proximal three-quarters or more red. Thorax sometimes more or less red. Dorsellum yellow (Graham 1995). Additional characters: forewing with isolated subcubital line of setae, F1 1.14 as long as F2, F2 about equal to F3.

Hosts. *Luffia lapidella* (Goeze) (Lepidoptera: Psychidae), *Meessia leopoldella* Costa (Lepidoptera: Tineidae).

Distribution. Palearctic: Europe (France, England, Jugoslavia, Hungary) (Ferrière 1947, Graham 1976, 1995).

Material examined: 1 ♀, Bulgaria, Rhodope Mts., Arda Valley, 2 km NE of Madzharovo Vill., 160 m, Malaise trap, 8-22.VI.2001 (H. Eturska) (DZUP).

***Elasmus steffani* Viggiani, 1967**

*Elasmus masii* Steffan, 1962: 36 [Lectotype, designated by Viggiani & LaSalle 1994: 18].

*Elasmus steffani* Viggiani, 1967: 158 [Replacement name for *Elasmus masii* Steffan, 1962 nec Ferrière 1929: 415].

Diagnosis. POL 2.0 – 2.5 OOL. All antennal segments longer than broad. F3 1.2 - 1.5 times as long as broad. Forewing with isolated subcubital line of setae. Body black with metallic tint, gaster ventrally reddish. Face dark brown with yellow spots near toruli and on vertex. Antenna pale yellow.

Hosts. Larval parasitoid of Braconidae (Hymenoptera), Tortricidae, Yponomeutidae (Lepidoptera) (Viggiani & LaSalle 1992, Graham 1995).

Distribution. Palearctic: (Italy, France, Spain, Israel, Greece, Turkey) (Viggiani & LaSalle 1992, Noyes 2009).

Material examined: 1 ♀, Bulgaria, Strandzha Mt., Tsarevo, 50 m, Moericke trap, 3-9.X.2001 (A. Stojanova); 1 ♀, Bulgaria, Kurdzhali region, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping on dry grass community, 4.IX.2006 (P. Boyadzhiev) (DZUP, ZISP).

***Elasmus unicolor* (Rondani, 1877)**

*Heptocondyla unicolor* Rondani, 1877: 182.

*Elasmus unicolor* (Rondani): Boucek, 1974: 271, 279.

*Elasmus unicolor* (Rondani): Graham, 1976: 298.

Diagnosis. Female. POL 2.7-3.2 OOL, OOL 1.3-1.4 OD. Hind margin of forewing straight. F1 as long as or slightly shorter than pedicel. F2 1.65-2.25 times, F3 1.45-2.0 times as long as broad. Gaster black, hind tibiae with their posterior edge or whole surface blackish. Male. OOL 1.4-1.5 OD. Body black, dorsellum and lamella yellowish.

Hosts. Larval parasitoid of Coleophoridae, Psychidae, Pyralidae (Lepidoptera) (Herting 1975, Trjapitzin 1978).

Distribution. Palearctic: Europe (France, Italy, Sweden, Germany, Moldova, Switzerland, Hungary, Bulgaria, Russia, Turkmenistan) (Trjapitzin 1978, Myartseva & Dzhanokmen 1989, Graham 1995).

Material examined: 1 ♀, Bulgaria, Rhodope Mts., Hrabrino Vill., 400 m, 1.VII.1995 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., Planinsko Vill., 1300 m, 4.VII.1997 (P. Boyadzhiev); 1 ♀, 2 ♂♂, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 17.V.2001 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, yellow trap, 27.V.2001 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., 2 km SE of Novo Selo

Vill., 200 m, yellow trap, 27.V.2001 (A. Stojanova); 1 ♀, 1 ♂, Bulgaria, Rhodope Mts., Plevun Vill., 400 m, Malaise trap, 17.VI.-1.VII.2001 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Daskalvo Vill., 500 m, 19.VI.2002 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping on grasslands, 23.VII.2004 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping, 15.IX.2004 (P. Boyadzhiev) (DZUP, ZISP).

***Elasmus viridiceps* Thomson, 1878**

*Elasmus viridiceps* Thomson, 1878: 205-206.

**Diagnosis.** Female. POL 2.0-2.9 OOL. Head and thorax with strong bluish or greenish-blue metallic tint. Forewing with short irregular bare area at base. Penultimate tergite not longer than its basal breadth. Male. POL 2.0 OOL, head and anterior part of thorax bluish.

**Hosts.** Pupal parasitoid of Coleophoridae, Gelechiidae, Tortricidae (Lepidoptera) and Bethyliidae, Chrysididae (*Goniozus claripennis* Forster) (Hymenoptera) or hyperparasitoid of Pteromalidae (Hymenoptera, Chalcidoidea) (Herting 1975, Trjapitzin 1978, Graham 1976, 1995).

**Distribution.** Palearctic: Europe (France, Greece, Moldova, Poland, Romania, Sweden) (Herting 1975, Trjapitzin 1978, Graham 1976, 1995).

**Material examined:** 3 ♀♀, Bulgaria, Rhodope Mts., Hrabrino Vill., 400 m, 1.VII.1995 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., E of Kapitan Dimitriev Vill., 300 m, 1.VII.2000 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Glavinitsa Vill., 350 m, 1.VII.2001 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., Daskalovo Vill., 550 m, screen sweeping, 15.IX.2004 (P. Boyadzhiev); 1 ♀, Bulgaria, Kjustendil region, Lelintsi Vill., 700 m, screen sweeping, 2.VIII.2008 (M. Antov); 3 ♀♀, Bulgaria, Sakar Mt., Jerusalimovo Vill., 90 m, screen sweeping on boggy grass community, 21.VIII.2008 (P. Boyadzhiev) (DZUP, ZISP).

***Elasmus westwoodi* Giraud, 1856**

*Elasmus westwoodi* Giraud, 1856: 185.

**Diagnosis.** Female POL 2.75-2.9 OOL, OOL 1.0-1.2 OD. F1 as long as pedicel and 2.0-2.2 times as long as broad, F 3 1.75-2.0 times as long as broad. Clava hardly broader than F3 and 3.25 -3.45 times as long as broad. Hind margin of forewing slightly concave. Body black, gaster reddish ventrally at base. Male. POL 2.7 OOL, OOL equal to OD. Dorsellum with yellow lamella.

**Hosts.** Larval-pupal parasitoid of Gracillariidae, Psychidae (Lepidoptera) (Herting 1975, Graham 1995).

**Distribution.** Palearctic: Europe (France, Germany, Slovakia, Hungary, Yugoslavia, Bulgaria, Turkey, Italy, Austria, Finland, Switzerland) (Herting, 1975; Graham, 1976, 1995).

**Material examined:** 1 ♂, Bulgaria, Rhodopi Mts., Krichim, 10.V.1982, (S. Petrov); 1 ♀, Bulgaria, Rhodope Mts., Odnyanovo Vill., 300 m, 2.V.1998 (P. Boyadzhiev); 1 ♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 250 m, 1.VII.2000 (A. Stojanova); 1 ♀, 3 ♂♂, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 17.V.2001 (A. Stojanova); 1 ♀, Bulgaria, Rhodope Mts., m. h. Chernatitsa, 1369 m, sweeping on grasslands, 18.V.2001 (P. Boyadzhiev); 2 ♀♀, Bulgaria, Rhodope Mts., 2 km SW of Novo Selo Vill., 200 m, 27.V.2001 (A. Stojanova); 1 ♂, Bulgaria, Rhodopi Mts., 2 km SW of Novo Selo Vill., 200 m, 17. VI.2001, (A. Stojanova) (DZUP, ZISP).

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