



**RECORDS OF SOME SPECIES OF *COPIDOSOMA* RATZEBURG
(HYMENOPTERA : ENCYRTIDAE) FROM INDIA,
WITH DESCRIPTION OF A NEW SPECIES**

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INTRODUCTION

Species of the genus *Copidosoma* Ratzeburg, so far as their biology is known, are polyembryonic parasitoids of lepidopterous larvae. From a single parasitoid egg laid in the body of the host larva, a large number, sometimes exceeding a thousand, adult parasitoids are produced. Recently, Manickavasagam & Kanagarajan (2003) record the emergence of 1893 adults of *C. floridanum* (Ashmead) from a single larva of *Helicoverpa armigera* (Hübner). A brief review of polyembryony in *Copidosoma* was given by Guerrieri & Noyes (2005; see additional references noted in this paper).

Kazmi & Hayat (1998) published the first revision of the Indian species of *Copidosoma*. These authors recognized 26 species (including two introduced species) from India. Later, one more species, *C. dasi* Hayat was added (Hayat, 2003; Hayat, 2006b). In a recent revision of the European species of *Copidosoma*, Guerrieri & Noyes (2005) recognized 56 valid species from Europe. In recent years, some already known species were recorded from India by Hayat (2006a), Hayat *et al.* (2007) and Hayat & Khan (2008).

In surveys made in Uttarakhand and Western Uttar Pradesh during 2009 a large number of specimens of *Copidosoma* were collected. On the request made by the second author to the Director of the Zoological Survey of India, the first author was permitted to visit Aligarh to study *Copidosoma* present in the collection of the Department of Zoology, A.M.U. Aligarh.

This study resulted in the identification of 6 known species of *Copidosoma*, and recognition of one new species. Data pertaining to the known species are recorded, and the new species is described.

Hayat (2006b) is followed for terminology. The following abbreviations are used for the depositories :

NPC – National Pusa Collections, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India.

NZSI – National Zoological Collections, Zoological Survey of India, Kolkata, India.

ZDAMU – Insect Collections, Department of Zoology, Aligarh Muslim University, Aligarh, India.

1. *Copidosoma clavatum* Myartseva

1982. *Copidosoma clavatum* Myartseva, 26, female, Holotype female: Turkmania, Kara-Kala.

1998. *Copidosoma clavatum* Myartseva : Kazmi & Hayat, 296, 304-305, female, Indian record.

2006b. *Copidosoma clavatum* Myartseva : Hayat, 73, 76, female, key, figures.

2008. *Copidosoma clavatum* Myartseva: Hayat & Khan, 126, female, Orissa and West Bengal records.

Material examined : INDIA: Kerala: Kottayam, Chengalam, 2 females (on slides, EH. 850, EH. 851), 26.ii.1993, Coll. S.B. Zeya. (NZSI, Registration No. 12350/H3 and 12351/H3).

Hosts : Unknown.

Distribution: India: Andhra Pradesh, Kerala, Orissa, Tamil Nadu, West Bengal. (Turkmania).

2. *Copidosoma eury stomum*, sp. nov. (Figs.1-8)

Female : Length, 1.08-1.29 mm, n=7 (1.19 mm) [The numbers in parentheses refer to the holotype measurements or ratios]

Body completely black; frontovertex dull bluish-green, face with some purple shine; mesoscutum largely bluish-green, bronzy purple anteriorly; scutellum bluish-green with bronzy purple in anterior half medially; tegulae dark brown; gaster with some faint violet shine. Antenna black. Fore wing hyaline; infuscate dark around marginal and postmarginal veins; hind wing hyaline. Legs dark brown to black; mid tibial spur white.

Head (Fig. 2) width 1.82x -2.02x (2.0x) as broad as frontovertex width; ocellar triangle with apical angle strongly obtuse; posterior ocelli separated from eye margins by about 1.5x diameters of an ocellus, and less than one ocellus diameter to occipital margin; malar space 0.52x - 0.59x (0.59x) eye length; mouth fossa 1.17x - 1.28x (1.22x) frontovertex width; frontovertex with regular polygonal reticulations, on side of facial impression slightly obliquely drawn-out, and on malar space elongate reticulate; setae brown; eyes setose, setae hyaline and each clearly longer than a facet. Mandible large (Figs.2, 3) 3-dentate, ventral tooth longest, dorsal tooth small and receding. Antenna (Fig.1) with scape cylindrical, about as long as pedicel and F1-4 combined; pedicel nearly as long as F1-3 combined; funicle segments quadrate (F1) to broader than long (F2-6), F4-6 individually longer than F3; clava 2-segmented; in one specimen (holotype), there is indication of a partial second suture; truncate part of clava slightly less than two third length of clava; clava at least about as long as preceding four segments combined. *Relative measurements* (holotype, slide): Head frontal width, 44; head frontal height, 38; frontovertex width, 22; mouth fossa width, 27; eye length, 21; malar space, 12.5; antennal scape length, 22.

Thorax : Mesoscutum with fine, reticulate sculpture; scutellum with a similar sculpture, but fades in about posterior half; setae brown; each side of propodeum with a few hyaline setae. Fore

wing about 2.2x as long as broad; marginal vein about 2x as long as postmarginal vein and subequal to stigmal vein; setation and venation as in Fig. 4. Hind wing about 4x as long as broad. Mid tibial spur shorter than basitarsus (9:13). *Relative measurements* (holotype, slide): Thorax length, 56; mesoscutum length, 23.5; mesoscutum width, 41; scutellum length, 26.5; scutellum width, 24; fore wing length, 118; fore wing width, 53; hind wing length, 85; hind wing width, 21; mid tibia length, 44; mid basitarsus length, 13; mid tibial spur length, 9.

Gaster : Ovipositor not exerted; ovipositor 0.86x -0.89x (0.87x) mid tibial length; third valvula 0.42x - 0.49x (0.49x) ovipositor length; ovipositor as in Fig.6; hypopygium as in Fig.5. *Relative measurements* (holotype, slide): ovipositor length, 38.5; third valvula length, 19 [Mid tibia length, 44; mid basitarsus length, 13; mid tibial spur length, 9].

Male : Similar to female except for the antenna (Fig. 7) and genitalia (Fig. 8). Antennal clava unsegmented. Phallobase 3.75x-4.0x as long as broad, and slightly more than 2.5x as long as mid basitarsus (28:11).

Material examined : HOLOTYPE, female (on slide, EH.1329): INDIA: Uttar Pradesh: Aligarh, Dhorau, 7.iii.2009, Coll. F.R. Khan. (Deposited in NPC).

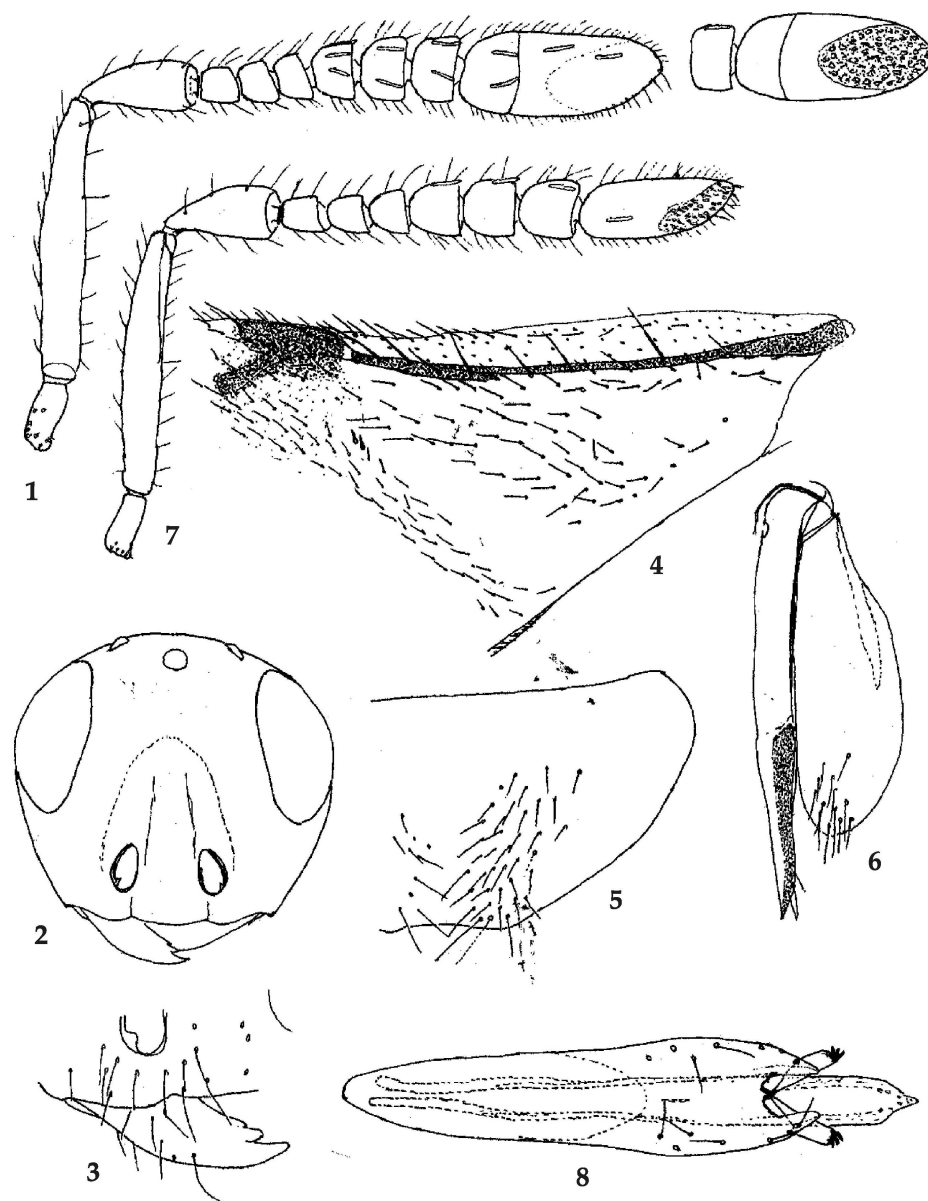
PARATYPES : 7 females, 14 males. INDIA: Uttar Pradesh: Aligarh, Dhorau, 3 females, 13 males (2 females and 2 males on slides, Nos. EH.1324, EH.1328, EH.1330, EH.1333), with same data as holotype; Aligarh, Harduaganj, 1 female, 1 male (on slides, Nos. EH.1331; EH.1332), 8.iii.2009, Coll. F.R.Khan. Rajasthan: Jodhpur, Sardar Samund lake, 2 females (on slides, Nos. EH.1343, EH.1344), 30.i.2001, Coll. S.I. Kazmi; Jodhpur, Khosia Meta, 1 female (on slide, EH. 1345), 20.i.2006, Coll. S.I. Kazmi. The paratypes are distributed as follows: 2 males in NPC; 1 female; 2 males, in NZSI, Reg. No. 12352/H3; 12353/H3 & 12354/H3; remaining paratypes in ZDAMU, Reg. No. HYM/CH/623.

Distribution : India: Rajasthan, Uttar Pradesh.

Hosts : Unknown.

Etymology : Greek. *eury*=wide, broad; *stoma*=mouth; refers to the very broad mouth fossa.

Remarks : This species is very close to *C. primulum* (Mercet) and was initially regarded as conspecific with Mercet's species. Dr. J.S. Noyes (BMNH) to



Figs. 1-8. *Copidosoma eurystomum* sp.nov., female except Figs. 7 and 8: 1, antenna; 2, head frontal aspect; 3, mandible; 4, Fore wing basal part showing venation and setation; 5, hypopygium, left half; 6, genitalia, left half; 7, antenna, male; 8, genitalia, male.

whom Hayat sent some figures was also of the same opinion. But it differs from the *primulum* in having the ovipositor clearly shorter than mid tibia; fore wing proximal to the linea calva with relatively more setae arranged in 5 lines; and phallobase 3.75x-4x as long as broad. In *primulum*: the ovipositor is 1.31x as long as mid tibia; fore wing proximal to the linea calva with setae arranged in 3 lines; and phallobase about 3.33x as long as broad.

3. *Copidosoma floridanum* (Ashmead)

1900. *Berecyntus floridanus* Ashmead, 365, female. U.S.A.: Florida, Biscayne Bay.
1988. *Copidosoma floridanum* (Ashmead): Noyes, 70, female, redescription, synonymy, taxonomy, figures.
1998. *Copidosoma floridanum* (Ashmead): Kazmi & Hayat, 298, 321-324, female, male, redescription, synonymy, figures; Indian records.

2005. *Copidosoma floridanum* (Ashmead): Guerrieri & Noyes, 104, 120-121; female, male, diagnosis, synonymy; hosts, distribution, key, figures, European and Indian records.

2006a. *Copidosoma floridanum* (Ashmead): Hayat, 303, female, Kanpur record, host. 2006b. *Copidosoma floridanum* (Ashmead): Hayat, 75, 79-80, key, hosts, distribution.

2007. *Copidosoma floridanum* (Ashmead): Hayat *et al.*, 40, female, male, Himachal Pradesh and Uttar Pradesh records.

This is a cosmopolitan species, with twelve other names as its junior synonyms (Noyes, 1988; Kazmi & Hayat, 1998; Guerrieri & Noyes, 2005).

Material examined : (Specimens on slides): INDIA: Tamil Nadu: Ooty, Doddabetta, 9 females (on 9 slides, Nos. EH.839-EH.847), 6.iii.1993, Coll. S.B. Zeya. Uttar Pradesh: Dehra Dun (now in Uttarakhand), F.R.I., 1 female (on slide, EH.859), 12.x.1979, Coll. S.I. Farooqi. Meghalaya: Jowai, Thaldskin, 1 female (on slide, EH. 1326), 22.x.2008, Coll. F.R.Khan. Assam: Guwahati, Sansari, 1 female (on slide, EH. 1335), 29.x.2008, Coll. F.R. Khan. Uttarakhand: Dehra Dun, Malsi, 1 female (on slide, EH. 1336), 4.xi.2009, Coll. F.R. Khan.

(Specimens on cards): INDIA: Orissa: Sambalpur, Buddharaja, 5 females, 11.xii.2007. Sikkim: Gangtok, Syari, 1 female, 1.vi.2008. West Bengal: Islampur, Gudish Basti, 2 females, 7.vi.2008; Islampur, Rasoolpur, 1 female, 9.vi.2008. Meghalaya: Ri Bhoi, Um Sam Lem, 1 female, 21.x.2008; Ri Bhoi, Lumdaitkhla, 1 female, 25.x.2008. Uttar Pradesh: Aligarh, Dhorau, 1 female, 7.iii.2009; Aligarh, Harduaganj, 1 female, 1 male, 8.iii.2009; Aligarh, Jawan, 3 females, 6.xi.2009. Uttarakhand: Udham Singh Nagar, Tanda, 3 females, 22.x.2009; Kashipur, Parmanandpur, 3 females, 24.x.2009; Kashipur, Pipalia, 1 female, 1 male, 24.x. 2009; Nainital, Nainagaon, 3 females, 25.x.2009; Haldwani, Gora Padao, 3 females, 26.x.2009; Ranikhet, Ardee Estate, 2 females, 27.x.2009; Ranikhet, Chaubatia, 2 females, 27.x.2009; Almora, Matela, 1 female, 1 male, 28.x.2009; Almora, Matikhola, 4 females, 28.x.2009; Ramnagar, Ghatti, 3 females, 30.x.2009; Ramnagar, Sauni, 1 female, 1 male, 30.x.2009; Roorkee, Chhiddarwala, 1 female, 2.xi.2009; Dehra Dun, Jeewangarh, 1 female, 3.xi.2009; Dehra Dun, Laxmipur, 3 females, 3 males, 3.xi.2009; Dehra Dun, Udaibagh, 1 female, 1 male,

3.xi.2009; Dehra Dun, Malsi, 4 females, 1 male, 4.xi.2009; Dehra Dun, F.R.I., 2 females, 4.xi.2009 (All Coll. F.R. Khan).

(Specimens in alcohol): 129 females, 44 males from the following districts of Uttarakhand: Udham Singh Nagar, Kashipur, Nainital, Ranikhet, Almora, Ramnagar, Roorkee, and Dehra Dun.

The following specimens deposited in NZSI: 3 females, 1 male (on cards) (NZSI, Reg. No. 12360/H3, 12361/H3) and 32 females, 2 males (Dehra Dun) (in alcohol in a vial), Reg. No. 12358/H3. Rest of the Material in ZDAMU.

Hosts : *Argyrogramma signatum*; *Helicoverpa armigera* (Noctuidae); [?] cabbage aphids; [?] sugarcane aphids.

Distribution : Cosmopolitan. India: Assam (new record), Bihar, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Meghalaya (new record), Orissa, Sikkim, (new record), Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal.

4. *Copidosoma gracilis* (Kaul & Agarwal)

1986. *Litomastix gracilis* Kaul & Agarwal, 20-23, female. Holotype female: India, Simla.

1989. *Copidosoma gracile* (Kaul & Agarwal): Hayat, 279, taxonomy.

1998. *Copidosoma gracilis* (Kaul & Agarwal): Kazmi & Hayat, 298, 319-320, female, male, key, figures, redescription, Uttarakhand, Himachal Pradesh, Kerala records.

2006b. *Copidosoma gracilis* (Kaul & Agarwal): Hayat, 74, 79, female, key, figures. 2007. *Copidosoma gracilis* (Kaul & Agarwal): Hayat, *et al.*, 40, female, Himachal Pradesh record.

Material examined : INDIA: Uttarakhand: Dehra Dun, Udaibagh, 2 females, 3.xi.2009, Coll. F.R.Khan; Dehra Dun, Laxmipur, 1 female, 3.xi.2009; Udham Singh Nagar, Fatehpur, 1 female (on slide EH. 1347), 22.x.2009, Coll.F.R.Khan. Two females in ZDAMU; two females in NZSI, Registration No. 12355/H3 & 12356/H3.

Hosts : Unknown.

Distribution : India : Himachal Pradesh, Kerala, Uttarakhand.

5. *Copidosoma indicum* Kazmi & Hayat

1998. *Copidosoma indicum* Kazmi & Hayat, 298, 320-321, female. Holotype female: India, Tamil Nadu, Shembaganum. [Also from Kerala and Karnataka].

2006b. *Copidosoma indicum* Kazmi & Hayat: Hayat, 75, 79, female, key, figures.

Material examined : INDIA: Karnataka: Bangalore, Nandi Hills, 1 female (on slide, No. EH.1334), 11.iii.2010, Coll. F.R. Khan. In ZDAMU.

Host : Unknown.

Distribution : India: Kerala, Karnataka, Tamil Nadu.

6. *Copidosoma transversum* Kazmi & Hayat

1998. *Copidosoma transversum* Kazmi & Hayat, 324-325, female. Holotype female: India, Kerala, Nelliampathy [Also from Mudigere, Periyar Anim. Sanc., Mudumalai Anim. Sanc., Aligarh].

2006b. *Copidosoma transversum* Kazmi & Hayat: Hayat, 75, 80, key, figures.

2007. *Copidosoma transversum* Kazmi & Hayat: Hayat *et al.*, 40, female, Himachal Pradesh record.

Material examined : INDIA: Uttar Pradesh, Aligarh, 2 females (on two slides, EH. 856, EH. 857), 15.ix.1978, Coll. M. Hayat & M. Verma. In ZDAMU; 2 females (on cards) from Himachal Pradesh (Hayat *et al.*, 2007b) deposited in NZSI, Registration No. 12357/H3.

Hosts : Unknown.

Distribution : India: Himachal Pradesh, Karnataka, Kerala, Tamil Nadu, Uttar Pradesh.

7. *Copidosoma varicorne* (Nees)

1834. *Encyrtus varicornis* Nees, 214, female. Lectotype female [designated by Graham, 1969: 295-295]. ? Germany.

1921. *Paralitomastix varicornis* (Nees): Mercet, 439, female.

1988. *Litomastix (Paralitomastix) varicornis* (Nees): Graham, 27.

1998. *Copidosoma varicorne* (Nees): Kazmi & Hayat, 295, 298-299, female, redescription, taxonomy, key, figures, Aligarh and Coimbatore record.

2005. *Copidosoma varicorne* (Nees): Guerrieri & Noyes, 105, 135, female, male, taxonomy, synonymy, redescription, figures, hosts, distribution.

2006b. *Copidosoma varicorne* (Nees): Hayat, 72, 75, female, key, figures, distribution, hosts.

2008. *Copidosoma varicorne* (Nees): Hayat & Khan, 126, female, West Bengal record.

Material examined : INDIA: Karnataka: Bangalore, GKVK, 1 female, 11.iii.2010, Coll. F.R. Khan. (NZSI, Registration No. 12359/H3).

Hosts : *Anarsia ephippias*, *A. sagmatica*; *Dichomeris eridontis* (Gelechiidae); *Eucosma* sp. (Tortricidae).

Distribution: India: Andhra Pradesh, Kerala, Punjab, Tamil Nadu, Uttar Pradesh, West Bengal (Pakistan; Palaearctic; Afrotropical).

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REFERENCES

- Ashmead, W.H. 1900. On the genera of chalcid-flies belonging to the subfamily Encyrtinae. *Proceedings of the United States National Museum*, **22**: 323-412.
- Graham, M.W.R. de V. 1969. Synonymic and descriptive notes on European Encyrtidae (Hym., Chalcidoidea). *Polskie Pismo Entomologiczne*, **39**: 211-319.
- Graham, M.W.R. de V. 1988. The remains of Nees von Esenbeck's collection of Hymenoptera in the University Museum, Oxford. *Entomologist's Monthly Magazine*, **124**: 19-35.
- Guerrieri, E. & Noyes, J.S. 2005. Revision of the European species of *Copidosoma* Ratzeburg (Hymenoptera: Encyrtidae), parasitoids of caterpillars (Lepidoptera). *Systematic Entomology*, **30**: 97-174.
- Hayat, M. 1989. Taxonomic notes on Indian Encyrtidae (Hymenoptera: Chalcidoidea). IV. *Oriental Insects*, **23**: 275-285.
- Hayat, M. 2003. Descriptions of two new species of Encyrtidae (Hymenoptera: Chalcidoidea) from West Bengal, India. *ZOOS' Print Journal*, **18** (11): 1239-1242.

- Hayat, M. 2006a. Descriptions of eight new species of Encyrtidae from India, with some records (Hymenoptera: Chalcidoidea). *Oriental Insects*, **40**: 303-315.
- Hayat, M. 2006b. *Indian Encyrtidae (Hymenoptera: Chalcidoidea)*: viii+496pp. Published by M. Hayat, Department of Zoology, Aligarh Muslim University, India.
- Hayat, M., Badruddin, S.M.A. & Khan, F.R. 2007. Records of some Encyrtinae and Tetracneminae from India (Hymenoptera: Chalcidoidea: Encyrtidae). *Bionotes*, **9** (2): 40-43.
- Hayat, M. & Khan, F.R. 2008. New records of Encyrtidae mainly from Orissa and West Bengal States of India (Hymenoptera: Chalcidoidea). *Bionotes*, **10**(4):125-128.
- Kaul, K. & Agarwal, M.M. 1986. Taxonomic studies on encyrtid parasitoids (Hymenoptera: Chalcidoidea) of India. *Aligarh Muslim University Publications (Zoological Series) on Indian Insect Types*, **13**: viii + 89pp.
- Kazmi, S.I. & Hayat, M. 1998. Revision of the Indian Copidosomatini (Hymenoptera: Chalcidoidea: Encyrtidae). *Oriental Insects*, **32**: 287-362.
- Manickavasagam, S. & Kanagarajan, R. 2003. Host and brood size of an egg-larval polyembryonic parasitoid, *Copidosoma floridanum* (Ashmead) (Hymenoptera: Encyrtidae) on *Helicoverpa armigera* (Hubner) from India. *Journal of Biological Control*, **17**(1):85-86.
- Mercet, R.G. 1921. *Fauna Iberica, Himenopteros Fam. Encirtidos*,. 727pp. Madrid.
- Myartseva, S.N. 1982. New Encyrtidae (Hymenoptera, Chalcidoidea) of the fauna of Turkmenia. *Izvestiya Akademii Nauk Turkmenskoy SSR*, 1982 (1): 21-29. [In Russian].
- Nees ab Esenbeck, C.G. 1834. *Hymenopterorum Ichneumonibus Affinium Monographiae, Genera Europaea et Species Illustrantes: Volumen secundum*. Stuttgartiae et Tubingae.
- Noyes, J.S. 1988. *Copidosoma truncatellum* (Dalman) and *C. floridanum* (Ashmead) (Hymenoptera, Encyrtidae), two frequently misidentified polyembryonic parasitoids of caterpillars (Lepidoptera). *Systematic Entomology*, **13**: 197-204.
- Trjapitzin, V.A. 1989. Parasitic Hymenoptera of the Fam. Encyrtidae of Palaearctics. *Opredeleteli po Faune SSSR, Izdavavaemiye Zoologiya In – Tom SSSR*, **158**: 1-489. [In Russian]