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Cricotopus zavreli sp. n. (Diptera, Chironomidae), a halobiontic non-biting midge from Poland

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The adults, pupa and larva of *Cricotopus zavreli* sp. n. are described. Its systematic position is discussed and a synopsis of its ecology and distribution is given.

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When studying the fauna of springs of Central Europe in 1934—1944 F. Pax collected some chironomids, which were identified by J. Zavřel. In mineral waters at Ciechocinek (Kujawy, Central Poland) and at Pomiarki near Truskavec (East Carpathians, Ukrainian SSR) an unknown saline species was recorded, and preliminarily named *Trichocladius* B (Zavrel 1946). Descriptions of the larva and pupa of this species were given by Zavrel (1946), and Zavrel & Pax (1951). The species was also discussed by Thienemann (1954), especially because the larva lacked anal papillae.

In his studies on the Diptera of saline habitats in Poland, the author Szadziewski (in press) found at Ciechocinek and at Inowrocław-Matwy of the Kujawy region three instars of a species whose larvae had no anal papillae. According to Zavrel (1946), the abdominal segments of *Trichocladius* B have lateral pencils of hairs, however, these were not present in the larvae found. This character is not mentioned in the redescription of the species by Zavrel & Pax (1951). Therefore it is supposed here that there must have been some confusion in the preliminary studies, and that the larvae of *Trichocladius* B from which the anal papillae are lacking are conspecific with *Cricotopus (Cricotopus) zavreli* sp. n. described below.

At first sight *C. zavreli* seems to belong to the *fuscus* group of the genus *Cricotopus*. This is due to the anagenetic level of the external morphology. In several features, however, *C. zavreli* differs from the diagnosis of the *fuscus* group. Therefore, rather than revise the existing diagnosis, it seems preferable to erect a new group, the *zavreli* group. Another reason for this decision is that, being a halobiontic species, *C. zavreli* is very different from the members of the *fuscus* group with regard to ecology.

Diagnosis of the *zavreli* group: Chaetotaxy of the head, thorax and abdomen of the adults, shagreened fields of the pupa and mouthparts of the larva as in the species of the *fuscus* group (Figs. 1 and 2). Male hypopygium with anterior (dorsal) part of the gonocoxite lobe more reduced than posterior (ventral) part. Female seminal capsules ovoid. *fr* of the pupa absent, d_l of segment VIII shifted laterally (seemingly 5 *l* bristles), *PB* on segment II. All *l* bristles of the larva single and very weak; anal papillae lacking.

The keys by Hirvenoja (1973: 136—138) can be supplemented as follows:

Males (p. 136)

10	(13)	Hypopygium without anal point; lobe of gonocoxite with dorsal (anterior) and ventral (posterior) part 10a
10a	(10b)	Dorsal (anterior) part not smaller than ventral (posterior) ..... *fuscus* group
10b	(10a)	Dorsal (anterior) part of gonocoxite lobe smaller than ventral (posterior) .... *zavreli* group

Females (p. 137)

15 (14) Seminal capsules ovoid. Legs and abdomen usually unicoloured, dark, or sometimes legs and first abdominal tergite with light markings. Lateral setae *(lb)* not very close to the lateral or hind margins of tergites III and IV .. 15a

15a (15b) Paratergital setae *(ptb)* on abdominal segments usually present .. *zavreli* group

15b (15a) *ptb* always lacking .. *cylindraceus* group

Pupae (p. 138)

11 (2) d_1 setae of the abdominal segment VIII usually located very laterally, in line with the *l* setae (seemingly 5 *l* setae); l_4 often strong. If d_1 clearly medial to the *l* setae, prothoracic horn without spines and rounded apically. *fr* setae mostly on the frontal apotome, sometimes (or occasionally) on the prefrons, or absent. Central patches of spines half-moon-shaped or kidney-shaped, always separate from the anal patches 11a

11a (11b) In salt water ..... *zavreli* group

11b (11a) In fresh or oligohaline water ..... *tremulus* group

Larvae (p. 138)

4 (3) Premandibular appendages absent. Hair pencils (l_4) on abdominal segments I—VI present or all setae simple 4a

4a (4b) Anal papillae long ..... *fuscus* group

4b (4a) Anal papillae lacking .... *zavreli* group

The reduction in the size of the gonocoxite lobes of *C. zavreli* differs from the main trend in *Cricotopus,* where the ventral (posterior) part of the lobe tends to be reduced earlier than the dorsal (anterior) part. In some specimens, or even species, the lobes are of almost the same size (cf. HIRVENOJA 1973, figs. 92-3, 98-3). The trend may, of course, lead from this to a weaker dorsal (anterior) and a greater ventral (posterior) lobe, as in *C. zavreli.*

The males of *C. zavreli,* as compared with those of the *fuscus* group, are perhaps a little more apomorphous than the plesiomorphous species of the latter. The females of *C. zavreli,* in contrast, seem to lack specific apomorphous features. The identification of the females of these two groups, even to group level, may be difficult although not impossible. The often reduced, plesiomorphous *ptb* bristles are not always a good key character. Their presence in most individuals of a population, however, serves to indicate the anagenetic level of the females, which is comparable with that of the males (double gonocoxite lobes) or the juvenile instars (for instance premandibles with two apical teeth) in the *zavreli* and *fuscus* groups.

On account of parallelisms, the number of useful key characters is often very limited. This is seen especially clearly in the pupae of different taxa, too. The pupa of *C. zavreli* closely resembles those of the *fuscus* group, this being a stasigenetic feature. But the apotypical position of the d_1 setae causes a resemblance to some species of the *tremulus* group without *fr* setae. The position of the setae is not completely constant, which may also make it more difficult to identify single specimens. The pupae of *C. zavreli* may therefore in accordance with the phylogenetic position of the group agree quite well with those of the *cylindraceus* group, too.

The larva of *C. zavreli* differs from those of the *fuscus* group in much the same way as the marine *Halocladius* differs from the limnic *Cricotopus.* In other respects, the larva of *C. zavreli* is of the *fuscus* type; the somewhat broader head is evidently a plesiomorphous feature. However, certain apotypical changes have occurred, i.e. the larvae have lost their anal papillae (and probably the hair pencils) and adapted to the new haline environment.

STRENZKE (1960) discussed at length the modifications of the anal papillae, which are often observed in field studies. In the species of haline waters the papillae are more or less reduced. Laboratory experiments showed, however, that increasing the salt content of the culture medium did not reduce the anal papillae of any species, and tended rather to enlarge them in *Chironomus aprilinus* (Meig.) (sub *C. halophilus* Kieff.) and *C. salinarius* Kieff. Strenzke therefore concluded that the reduction of the papillae was not caused by the salt content, as had been suggested by the previous authors.

Earlier, HAAS & STRENZKE (1957) summarized their studies on the anal papillae of *Chironomus riparius* Meig. (sub *C. thummi* Kieff.) and *C. piger* Str. (as subspecies of *thummi)* roughly as follows: The anal papillae are highly modifiable in size and form, and in histological differentiation. This depends upon the electrolytes present in the culture medium. The modifications range from conspicuous enlargement to complete reduction, depending on the nature of the electrolyte to which they are exposed. Salt solutions (especially NaCl) generally cause

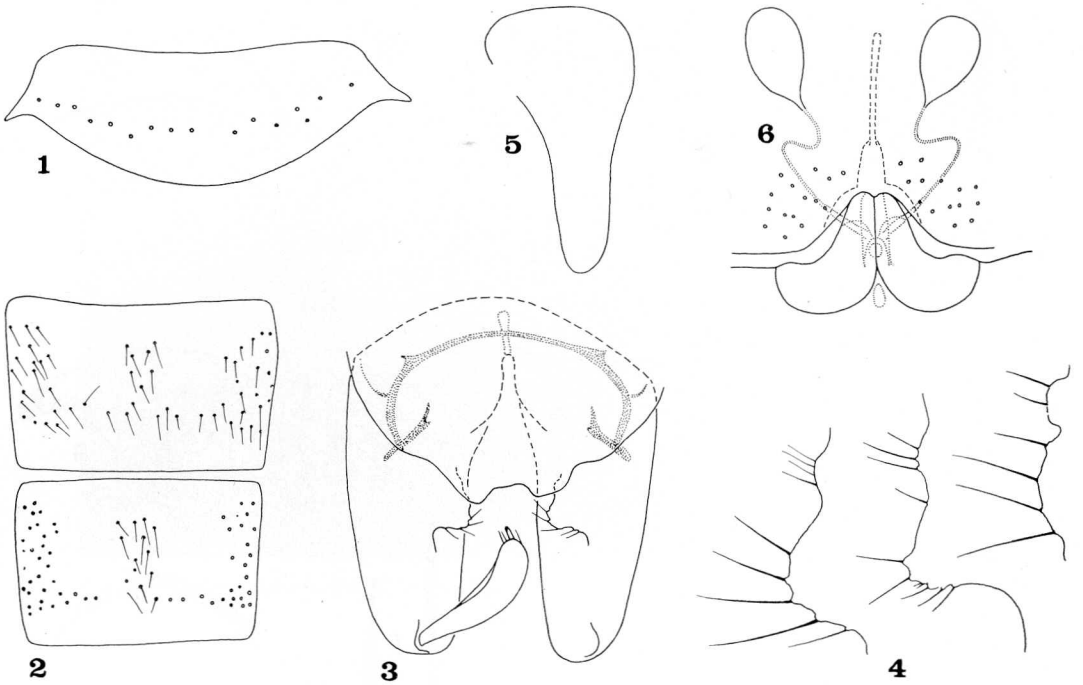

Fig. 1. *Cricotopus (C.) zavreli* sp. n., scutellum (1), tergites III and IV (2), male genitalia (3), variety of the lobe of gonocoxite (4), lateral view of cercus (5), female genitalia (6).

reduction in the size of the papillae. Whether or not and to what degree the changes occur depends upon the nature and concentration of other ions simultaneously present, the effect of the electrolytes on the development of the papillae being the result of an ionic equilibrium.

STRENZKE (1960) further discussed the significance of the anal papillae in the metabolism of chlorine, which, according to the literature, the papillae take up from the medium. Lack of chlorine ions was found to be a factor limiting the distribution of some chironomids in alpine waters, where enlarged anal papillae were also found.

C. zavreli is an addition to the group of halobiontic chironomids whose anal papillae are more or less reduced or lacking. How such parallel development has come about is not easy to see, but obviously the same causes operate in different species.

Another similarity between the species of *Halocladius* and *C. zavreli* is the small lateral hairs (l_4) of the larva. According to REMMERT (1955 sub *Trichocladius vitripennis* Meigen), the larvae of *Halocladius variabilis* Staeg. cannot swim, but sink almost motionless to the bottom. This may be an adaptation tending to increase the survival of *H. variabilis*, because such behaviour would perhaps help the larvae to avoid greater depths in the tidal zone. The larvae of *Cricotopus*, in contrast, usually live in the phytal, are active swimmers and have conspicuous hair pencils. Whether the absence of the hair pencils is in some way connected with behaviour in *C. zavreli* is still unknown.

In its principal traits the systematic position of the *zavreli* group is quite clear. One might assume that it is an apotypical sister group of the *fuscus* group. The great ecological isolation may suggest the existence of

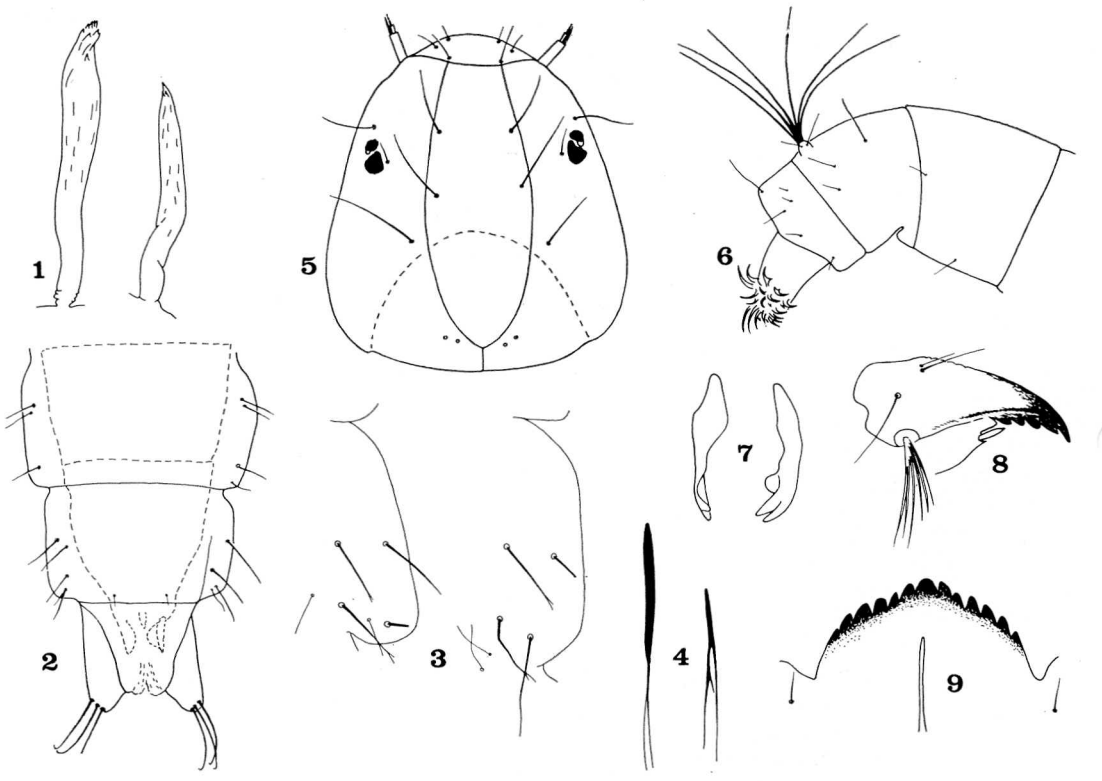

Fig. 2. *Cricotopus (C.) zavreli* sp. n., prothoracic horn (1), anal part of (female) pupa (2), variety of the setae on segment VIII (3), furcate setae of segment VIII (4), head of the larva (5), lateral view of the last segments (6), premandible (7), mandible (8), hypochilum (9).

other, still unknown species of this group. Until additional information is available, further phylogenetic discussion is pointless. As shown by MICHAILOVA (1980) cytotaxonomic studies may afford new insights into the interspecific relationships.

Cricotopus (Cricotopus) zavreli sp. n.

Male

Thorax yellowish with green undertone. Scutal stripes, scutellum, postnotum and lateral sclerites of meso- and metathorax

Table 1. Length of legs of male *Cricotopus zavreli* sp. n., in µm.

	fore leg	middle leg	hind leg
fe	876 /713— 946/	936 /744—1085/	888 /775—1023/
ti	1074 /853—1318/	939 /775—1116/	1130 /915—1271/
ta1	727 /628— 837/	459 /372— 543/	621 /523— 729/
ta2	403 /372— 450/	246 /186— 295/	323 /279— 388/
ta3	289 /264— 310/	196 /163— 233/	255 /186— 310/
ta4	194 /186— 202/	137 /116— 155/	149 /124— 171/
ta5	136 /124— 155/	121 /108— 140/	130 /109— 140/

Fig. 3. Saline water bodies in Inowrocław-Matwy.

dark brown. Antepronotum and apex of halteres pale yellow. Legs brown, trochanters of all legs yellow, coxae of fore legs also pale. Tarsi somewhat paler than femora. Abdomen uniformly brownish.

Eyes pubescent. Setae on clypeus 9—14, postorbitals more than 10, inner verticals 2. *AR* 2.39 (2.0—2.57). Length of maxillary palp segments in μm: 68—78, 107—117, 117—125 and 162—181.

Lateral setae on antepronotum 6—8, acrostichals 13—16, dorsocentrals 21—31, posterior notopleurals 4—5, scutellars 14—17 (Fig. 1_1). Thorax otherwise without setae. Length of wing 2.4 (2.1—2.7) mm. Squama with 16—36 setae. About 9 sensillae chaeticae on the proximal part of the basitarsus of the hind leg and about 3 on the basitarsus of the middle leg. Pulvilli not developed. *LR* of fore leg 0.65 (0.61—0.67), middle leg 0.50 (0.49—0.50) and hind leg 0.56 (0.54—0.57). Legs in μm as in Table 1.

Numbers of setae on third and fourth tergites of abdomen (Fig. 1_2):

	medial setae	lateral setae
III tergite	10.8 /8—15/	22.8 /18—27/
IV tergite	11.2 /6—15/	23.7 /16—30/

Table 2. Length of legs of female *Cricotopus zavreli* sp. n., in μm.

	fore leg	middle leg	hind leg
fe	832 /698— 899/	905 /767—1008/	871 /767— 961/
ti	1060 /868—1194/	942 /790—1085/	1069 /802—1225/
ta_1	629 /481— 729/	442 /384— 496/	599 /488— 682/
ta_2	344 /279— 372/	241 /209— 264/	312 /256— 341/
ta_3	248 /217— 264/	184 /162— 202/	242 /209— 264/
ta_4	171 /155— 186/	125 /105— 140/	141 /116— 155/
ta_5	133 /124— 140/	125 /105— 140/	130 /116— 140/

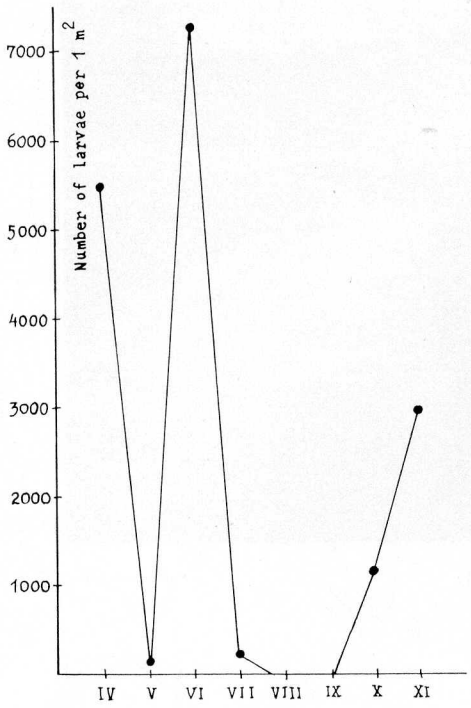

Fig. 4. Seasonal dynamics of larvae in saline inland area in Inowrocław-Matwy during 1975.

(1.9—2.7) mm. *LR* of fore leg 0.59 (0.55—0.61), middle leg 0.47 (0.44—0.49), hind leg 0.57 (0.54—0.61). Sensillae chaeticae numbering 17—26 on about proximal 0.4 of basitarsus of middle leg, fewer on basitarsus of hind leg — up to 13—14. Legs in μm as in Table 2.

Numbers of setae on third and fourth tergites of abdomen:

	medial setae	lateral setae
III tergite	7.5 /4—10/	16.8 /11—23/
IV tergite	7.0 /5— 9/	16.8 / 8—24/

Paratergites of abdominal segments III and IV with 0—2 setae. Genitalia as in Fig. 16. Seminal capsules fairly ovoid, dark, only neck somewhat paler. Length of seminal capsule 106 (88—119) μm, width 64 (57—68) μm.

Pupa. Length of exuviae about 5.0—5.7 mm. Frontal setae absent. Thoracic horn (Fig. 21) 186 (166—209) μm long, about 8.5 times as long as greatest width. Antepronotum with 2 medial and 1 lateral setae. 3 humerals, 4 dorsocentrals and 1 prealar seta present.

Small *PSB* on segment II; 60—61 hooklets in 2 rows. Tergites III—IV with shagreened

Hypopygium (Fig. 13) without anal point. Gonocoxite lobe double; ventral (posterior) part of lobe rounded, much larger than dorsal (anterior) part (Fig. 14).

Female

In colour similar to male, but somewhat paler. Cerci (Fig. 15) yellow. Setae on clypeus 10—14, postorbitals more than 10, inner verticals 2. Antennae with 5 flagellomeres, last flagellomere 3.3 (2.9—3.7) times as long as fourth flagellomere, flagellomeres 2—4 equal in length, first flagellomere 2 times as long as next one, preapical seta present. Length of maxillary palp segments in μm: 59—72, 88—103, 99—121, 174—183. Lateral setae on antepronotum 5—8, dorsocentrals 24—29, posterior notopleurals 4—7, scutellars 14—17, acrostichals about 15. Thorax otherwise without setae. Length of wing 2.4

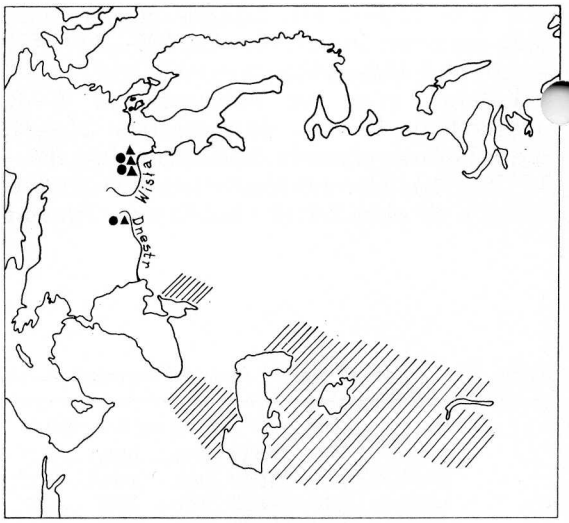

Fig. 5. Known distribution of *Culicoides longicollis* Glukhova (Ceratopogonidae) ▲ /////// and *Cricotopus (C.) zavreli* sp. n. ●

fields as in *Cricotopus fuscus;* oral field almost semicircular, caudal field of tergites III and IV divided into two patches. d_l of segment VIII in line with the (four) lateral setae on one or both sides, seldom more medially, as in *fuscus* group, on both sides; often four *l* setae on segment VIII, too. *l* setae single or furcate. Anal setae (Fig. 2_2) 242 (234—250) µm, longer than half length of anal segment.

Larva. Body length up to 7 mm. Colour olivaceous green, head capsule dark brown. *IC* 86 (83—89). Antenna with five segments, *AR* 0.65 (0.63—0.68), Lauterborn's organ clearly visible. Premandible with two teeth (Fig. 2_7), mandible (Fig. 2_8) with mesal brush composed of 6 hairs, lower lip (hypochilum) (Fig. 2_9) with 13 teeth, median tooth broadest. Other mouthparts also as in the species of the *fuscus* group. Thorax and abdomen with very weak simple setae only. Preanal papillae with two short setae on outer side and six long apical setae measuring about 600 µm (Fig. 2_6). Anal papillae absent.

Material examined. Inland saline area in Ciechocinek near Torun, water salinity 34.5—50.5 ‰: 30.V 1975, 2 larvae, 1 pupa, 3 females, 4 males.

Inland saline area in Inowrocław-Matwy, water salinity 18.4—84.6 ‰: 5.III 1975, 4 larvae, 3 females, 2 males; 18.IV 1975, 20 larvae, 6 pupal exuviae, 3 female pupae and 1 male pupa, 3 females, 4 males; 15.V 1975, 2 males; 13.VI 1975, 1 male; 4.X 1975, 2 males.

Holotype: 1 male, Inowrocław-Matwy, 18.IV 1975 R. Szadziewski leg. in the collection of the Institute of Zoology, Polish Academy of Science, Warsaw. Paratypes in the collection of R. Szadziewski (University of Gdansk) and in the Zoological Museum of Helsinki.

Ecology, distribution

The new species is halobiontic. According to ZAVREL (1946), the water salinity at Ciechocinek and near Truskavec, where its larvae and pupae were obtained, ranged from 20 to 45 ‰. *Cricotopus zavreli* was found by the author Szadziewski in two inland saline habitats when 12 saline habitats of various types (marine, estuarine and inland saline habitats) were investigated in Poland. The water salinity at these two stations fluctuated during the year from 18.4 to 84.6 ‰ (Szadziewski, in press). The larvae occurred in small, shallow water bodies (Fig. 3) mainly among filamentous green algae of *Rhizoclonium* (Agarth) and *Microspora stagnorum* (Kütz.). The largest number of larvae was observed during the spring, up to 7300 per 1 m² of the bottom in June. During the summer the presence of hydrogen sulphide caused their number to fall to zero, in autumn it increased again (Fig. 4). Imagines were observed during the spring and autumn.

The new species probably represents an arid Afro-euroasian zoogeographical element (OLSUFJEV 1977), for its known distribution is similar to that of the halobiontic biting midge *Culicoides (Monoculicoides) longicollis* Glukhova (Ceratopogonidae) (Fig. 5). This biting midge was described from Truskavec (Ukraina) and then reported from the Doneck territory, Transcaucasus, Kazachstan, Turkmenia and Kirgisia (GLUKHOVA 1971, 1979). It also occurs in strongly salinized habitats in Kujawy (Szadziewski, in press).

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