

# Hemp sawfly found in European Russia (Hymenoptera: Tenthredinidae, Nematinae, Cladiini)

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The hemp sawfly *Trichiocampus cannabis* Xiao & Huang, 1986 was known until now only in the East Palaearctic. One female was captured recently in the Uljanovsk Region, European Russia. This is the first record from the West Palaearctic. The species is compared with the type species of *Trichiocampus* Hartig, *T. grandis* (Serville). The hemp sawfly differs from all known species of Cladiini by having slender, simple claws. The food plant *Cannabis sativa* L., a herb of the family Cannabaceae, is unique in Cladiini.

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## 1. Introduction

Hemp (*Cannabis sativa* L.) has been cultivated by humans throughout recorded history as a source of fibre, seed oil, food, and a drug used for recreation, spiritual enlightenment and in medicine. Two species of sawflies are known to feed on it. The hemp sawfly *Trichiocampus cannabis* Xiao & Huang (Tenthredinidae) eats leaves e.g. in China, and the purslane sawfly *Schizocerella pilicornis* Holmgren (Argidae) bores in the stalks of the plant in Mississippi, USA (McPartland *et al.* 2000).

The hemp sawfly *Trichiocampus cannabis* was described from Lu'an, Anhui Province, China by Xiao and Huang in Xiao *et al.* (1986). Takeuchi (1949) previously cited "*Trichiocampus cannabis*, in litt." in referring to a species feeding on *Cannabis sativa* in Japan, but he never described the species. Wang *et al.* (1987) treated the biology of the hemp sawfly: it is one of the main pests of hemp in Liu'an hemp district. The larva is monophagous on *C. sativa* and feeds on leaves by skeletonizing them and later making many holes or ragged edges, sometimes only

sparing leaf stalks and main veins. Laboratory rearing and field observations have shown that the hemp sawfly occurred in two generations per year. It overwinters in the soil as a mature larva. Pupation takes five to seven days. Females live for about a week in spring. Eggs are white, oblong, up to 1 mm long; they hatch in four to seven days. Larvae undergo five moults before maturity. They have a pale body up to 10 mm long, the head is dark. The feeding period takes 27–32 days. The species is capable of parthenogenetic reproduction.

The hemp sawfly has been reported from Blagoveshchensk, Amur oblast, in the southern Russian Far East [Zhelochovtsev & Zinovjev 1992, as *Cladius* (?*Trichiocampus*) *cannabis* (Xiao & Huang, 1986), 1995, as *Cladius cannabis*]. In the world catalogue of Symphyta (Taeger *et al.* 2010) the species is listed as *Cladius* (*Trichiocampus*) *cannabis* (G. Xiao & X. Huang, 1986) from the East Palaearctic. In this article the original name combination is used, because it is shorter and simpler, and the earliest authors have treated *Trichiocampus* as a genus.

In the present study the hemp sawfly is re-

corded from the West Palaearctic for the first time and it is compared with *T. grandis* (Serville), the type species of *Trichiocampus* Hartig.

## 2. Material and methods

The first European female was among specimens of sawflies from Uljanovsk Region, European Russia, which were sent to me for identification in 2004 from Uljanovsk State University by Dr. Vadim V. Zolotuhin. The female is labeled “30.V. 1993, RUS, Uljanovsk Region, Radistchevo district, Viazovka, S. Buganin leg.” I showed this unusual specimen to Dr. Alexey Zinovjev, Randolph, MA, USA, who suggested it to be a hemp sawfly.

In 2011 one female and one male hemp sawfly were received as an exchange from Dr. Meicai Wei, Changsha, China. The specimens had been captured in Gansu Province, China; the male on 24.V. 1982 in Gangu, on wheat field, Wang Jinchuan leg., and the female on 31.V.1984 in Hui-ning, Wang Jinchuan and Jia [last name of another collector] leg. The Chinese locality labels were kindly translated into English for me by Dr. Meicai Wei. Both specimens bear his identification label “*Trichiocampus cannabidis* Xiao & Huang, 1986, det. Wei M. 2011”.

These specimens were compared with each other and with other specimens of the *Trichiocampus* species, notably with the type species of the genus, *T. grandis* (Serville). The terminology of body parts and conventions used in measurement are as in Vikberg and Zinovjev (2006). Postocellar line (POL) was measured as the distance between the inner margins of the lateral ocelli; ocello-ocular line (OOL) as the distance between the outer margin of one lateral ocellus and the inner margin of the compound eye of the same side. Ocellar diameter (OD) was measured as the maximum width of one lateral ocellus.

One further Chinese female of *T. cannabidis* in the collection of SDEI, Müncheberg was photographed by Andrew Liston, and two of these images are presented in this paper. This female was captured in Gansu Province, Linxia, Nanlongwan on 21 May, 1985 by Wang Jinchuan, and identified in 2009 as *Cladius cannabidis* (Xiao & Huang, 1986) by M. Wei. This specimen was not studied by the present author.

## 3. Systematics

Three genera of Cladiini, *Cladius* Illiger, 1807, *Priophorus* Dahlbom, 1835 and *Trichiocampus* Hartig, 1837 have been regarded by many authors as valid genera, or the latter two have been placed as subgenera in *Cladius* as in Taeger *et al.* (2010). Zhelochovtsev (1952) included all Palaearctic species in *Cladius*. Some species have been placed in different genera by different authors. So, Benson (1958) included two European species in *Priophorus*, *pilicornis* (Curtis) and *ulmi* (Linné) (= *laevifrons* Benson), both of which are more properly placed in *Trichiocampus* according to Smith (1974). The treatment of the three genera in North America (Smith 1974) is based on genital characters and morphology of lancets and this treatment seems to correlate with characters of larvae (Lorenz & Kraus 1957). Rather similar adult characters were used to distinguish three genera in Japan by Takeuchi (1952).

Using the key to genera in Smith (1974) the females of *cannabidis* would run to *Trichiocampus* and also the penis valve of the male fits that genus. The type species of the genus is *Nematus grandis* Lepeletier [= *Nematus grandis* Serville]. It occurs in North America, probably as an introduction, and is dealt with in the work by Smith under the name *Trichiocampus viminalis* (Fallén). Its lancet (fig. 18) and penis valve (fig. 29) are illustrated. Several morphological characters are clearly different in *cannabidis* and *grandis*.

## 4. Characters of the hemp sawfly and comparison with *T. grandis*, the type species of *Trichiocampus*

### 4.1. Diagnostic characters of the hemp sawfly in the original description

The type series of *T. cannabidis* Xiao & Huang consisted of 8 females, one of them the holotype, and 6 males captured on 24.IV.1979 at Lu'an, Anhui Province, China by Wang Ting-Kui. The original description is mostly in Chinese. The length of body of female is 6.0–6.8 mm and that of male 4.7–5.3 mm. The species was compared with *T. viminalis* (Fallén) [= *T. grandis* (Serville)] and it



Fig. 1. Female of *Trichiocampus cannabis* Xiao & Huang from Huining, China, dorsal view. Length of body 6.6 mm. Photo by Pekka Malinen.

differs from the latter in the following characters: antenna, wing veins, and first abdominal tergum are black, and costa and stigma are brownish black. The sawsheath was figured in lateral (fig. 6) and dorsal view (fig. 7). The straight and rather narrow lamnium of lancet (fig. 8) has 17 segments. The penis valve (fig. 9) is narrow and has two spines apically.

#### 4.2. Comparison of the hemp sawfly with *T. grandis*

##### 4.2.1. Colour

Colour characters alone are sufficient to distinguish the hemp sawfly from *T. grandis*.

The two females of the hemp sawfly inspected in the present study (one from China and one from European Russia) are very similar and they belong to the same species.

Hemp sawfly female (Chinese) (Fig. 1): Head, including antenna, black. Mandible apically amber red. Palpi brownish yellow. Thorax yellowish red, except anterior margin of propleuron, prosternum, caudal margin of mesoscutellum, mesosternum and metanotum black. Wings infusate, less so apically, veins and stigma brownish black, basal 0.2 of costa yellowish. Abdomen reddish yellow, except: tergum 1 black, last tergum dark brown, cercus brown and sawsheath brownish black. Photographs of the female in SDEI, Müncheberg (Fig. 2: head and Fig. 3: body laterally).

Russian female compared to Chinese female:



Fig. 2. Anterior view of female head of *Trichiocampus cannabis* from Linxia, China, in coll. SDEI, Müncheberg. Photo by Andrew Liston.

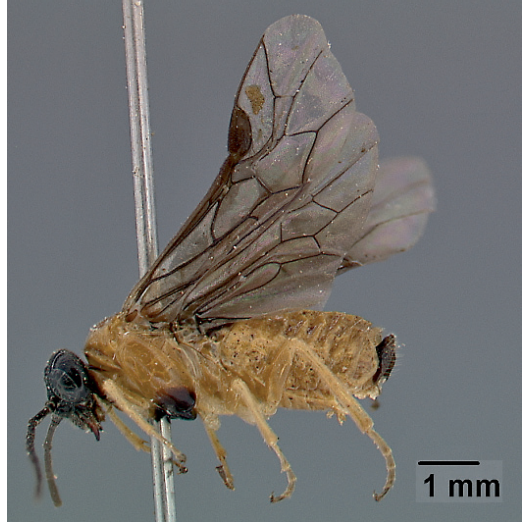


Fig. 3. Lateral view of female body of *Trichiocampus cannabis* from Linxia, China, in coll. SDEI, Müncheberg. Photo by Andrew Liston.

slightly darker; blackish spots on anteromedian parts of mesoscutal lobes; metapleuron blackish.

Hemp sawfly male (Chinese) (Fig. 4): Similarly coloured to the Chinese female, but thorax black, except for the hind margin of pronotum yellow and tegula brown, partly infusate. Bases of coxae, trochanters blackish infusate. Abdomen reddish yellow, except tergum 1 black and apical tergum dark brown.

Female of *T. grandis*: black head; antennae black with a brown underside. Thorax yellow, except for prothorax, mesoscutum, mesoscutellum,



Fig. 4. Male of *Trichiocampus cannabis* from Gangu, China, lateral view. Length of body 5.8 mm. Photo by Pekka Malinen.

metascutellum and lower part of mesepisternum black. Wings basally yellowish, apically hyaline, costa yellow, stigma from yellow to brown with base and often margins dark brown to black, other veins brown. Abdomen yellow. Male similarly coloured as female, except antennal flagellum wholly brown.

#### 4.2.2. Morphology

The morphological characters are partly very different and these are compared below. The three specimens of *T. cannabis* at hand and one reared female and male of *T. grandis* from Finland were measured and they were used for the comparison. The measurements of the specimens are included in the Appendix.

The differences in some structures (especially in antenna and claw) are so great that the two species could be placed in different genera. At first I actually thought to create a new genus for the hemp sawfly. The following morphological characters were found to differ clearly in *T. grandis* and *T. cannabis* specimens:

**Head.** Malar space about as long as diameter of lateral ocellus in *T. grandis*, about 0.5 as long in *T. cannabis*. POL/OOL index 1.14–1.3 in *T. grandis*, 0.94–0.98 in *T. cannabis*.

**Flagellum.** Flagellomere 1 in lateral view curved in female of *T. grandis* (Fig. 5a), straight

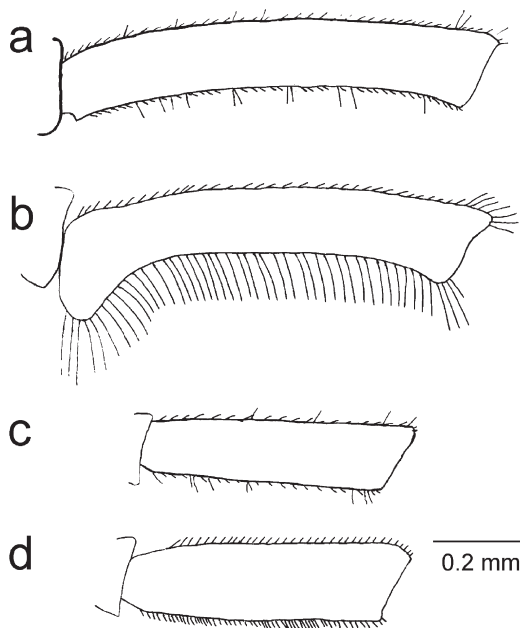


Fig. 5. Flagellomere 1 in inner lateral view. – a. Female of *Trichiocampus grandis*. – b. Male of *T. grandis*. – c. Female of *T. cannabis*. – d. Male of *T. cannabis*.

in female of *T. cannabis* (Fig. 5b), curved and its ventral margin with long hairs and basally with nodus in male of *T. grandis* (Fig. 5c), straight, without basal nodus and its upper and lower margin covered by short setae in male of *T. cannabis* (Fig. 5d). Flagellum longer and relatively thinner in *T. grandis*; so flagellomere 7 about 9 times as long as wide in *T. grandis*, 4–5 times as long as wide in *T. cannabis*.

**Wings.** Forewing with 4 submarginal cells in *T. grandis* (first crossvein partially developed), with 3 submarginal cells in *T. cannabis* (first crossvein totally missing).

**Legs.** Hind tarsomere 1 about as long as two following tarsomeres together in *T. grandis*; about as long as three following tarsomeres together in *T. cannabis*. Claws thick, subbifid in *T. grandis* (Fig. 6a); slender, simple in *T. cannabis* (Fig. 6b).

**Sawsheath.** Sawsheath not reaching caudal margin of abdomen in *T. grandis* (Fig. 6c), whereas in *T. cannabis* (Fig. 6d) projecting distinctly more caudad of this. Sawsheath: length/width index about 4.2 in *T. grandis*, about 3.5 in *T. cannabis*. Cercus in lateral view about 1.8 as long as

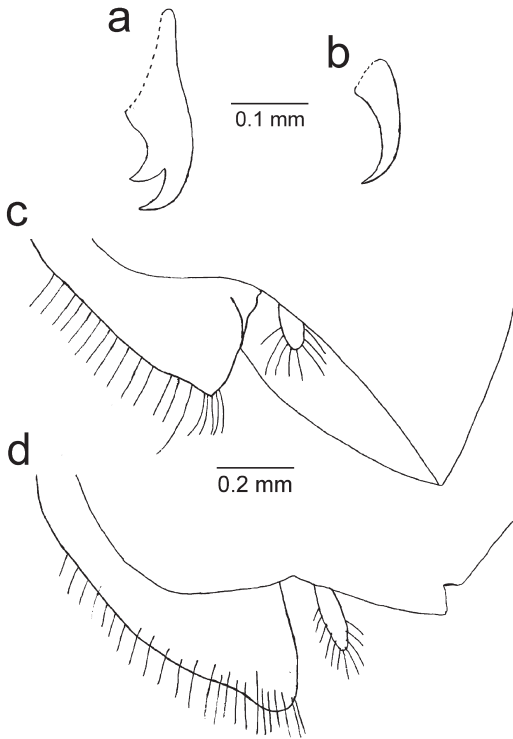


Fig. 6. – a. Hind claw of female of *Trichiocampus grandis*. – b. Mid-claw of female of *T. cannabis*. – c–d. Apex of abdomen of female *Trichiocampus grandis* (c) and *T. cannabis* (d), lateral view.

wide in *T. grandis*, about 2.8–3.3 as long as wide in *T. cannabis*.

Lammium of lancet. Length/width index in *T. grandis* 3.5, in *T. cannabis* 4.8. Number of annuli (or teeth) 14–15 in *T. grandis*, 16–17 in *T. cannabis*. Form of annuli and teeth different. First annulus parallel with second annulus in *T. grandis*, distinctly divergent from it in *T. cannabis*.

Penis valve. Apical spines parallel in *T. grandis*, diverging caudad in *T. cannabis*.

## 5. Characters of the hemp sawfly in the context of Cladiini

The hemp sawfly is close to some species of *Trichiocampus* but some of its characters are more like *Priophorus*. The lancet and male genitalia are more like those in *Trichiocampus*, but flagellomeres fit *Priophorus* better. It differs from all other known species of Cladiini by structure of claws (simple, no subapical tooth). Also the food

plant (*C. sativa*) is a herb of Cannabaceae which is unique in Cladiini. The other species of *Trichiocampus* feed on trees and bushes of Salicaceae, Ulmaceae and Rosaceae (Benson 1958, Smith 1974, Togashi 1985).

Three species of *Trichiocampus* were listed from China in Wei *et al.* (2006) beside *T. cannabis*: *T. rufus* (Verzhutskii, 1966) (= *T. pseudoviminalis* Huang & Wang, 1993; see Wei & Nie 1998), *T. prunii* Takeuchi, 1956 (= *Cladius takeuchii* Liston, Taeger & Blank, 2009) and *T. yunanensis* Haris & Roller, 1999; they all have claws with subapical teeth. The last mentioned species was later transferred to *Anhoplocampa* Wei by Wei and Niu (2011). Nie and Wei (2009) described two new species from China: *T. femoratus* and *T. infumatus*, and they also presented a key to the known Chinese species of the genus. The two last mentioned species have claws with subapical teeth, and long basitarsi in forelegs and hind legs. Thus, some species of *Trichiocampus* can have long basitarsi (longer than three following tarsomeres together), although in the type species they are short (as long as or shorter than two following tarsomeres together).

## 6. Discussion

The species of Cladiini are easily separated from other species of the large subfamily of Nematinae. The fore wing venation of the adults is characteristic (Benson 1958) and the morphology of larvae is clearly different from other nematine larvae (Lorenz & Kraus 1957). So far four genera or subgenera are known in the Palaearctic, Nearctic and Oriental, some species have been introduced into the Neotropical and Australasian Regions (Taeger *et al.* 2010). It was interesting to note that Saini *et al.* (2006) wrote that there is one new undescribed genus in India which is close to *Priophorus*. *Trichiocampus cannabis* is not known from India. So, apparently the species which belongs to the undescribed genus, is different.

Via future studies it would be interesting to learn more about the morphology, particularly the chaetotaxy, of the larva of the hemp sawfly. DNA sequence studies could elucidate the relationships and the phylogeny of Cladiini.

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Appendix. Measurements of body parts (lengths in millimeters if not stated otherwise) of the studied specimens of *Trichiocampus cannabis* Xiao & Huang, and for comparison of one female and one male of *Trichiocampus grandis* (Serville).

	<i>T. cannabis</i>			<i>T. grandis</i>	
	Female	Female	Male	Female	Male
Origin	China Huining	Russia Viazovka	China Gangu	Finland Helsinki <sup>1</sup>	Finland Kemi, Ajos <sup>2</sup>
Body	6.6	5.8	5.8	9.2	7.4
without sawsheat	6.3	5.6		9.2	
Fore wing	6.5	5.6	5.6	9.2	6.1
Costa	3.4	3.3	2.9	4.8	3.2
Head					
Width	1.57	1.60	1.43	2.40	1.98
Height	1.35	1.35	1.16	1.82	1.42
Length	0.95	0.95	0.85	1.35	1.05
Malar space	0.06	0.06	0.05	0.20	0.13
Intertorular dist.	0.22	0.24	0.19	0.29	0.16
Compound eye	0.67×0.45	0.70×0.45	0.61×0.42	1.04×0.65	0.88×0.60
Dist. between eyes					
on frons	1.04	1.10	1.00	1.60	1.28
on face	1.05	1.07	0.95	1.56	1.21
POL <sup>3</sup>	0.33	0.32	0.29	0.48	0.44
OOL <sup>3</sup>	0.34	0.34	0.31	0.42	0.33
OD <sup>3</sup>	0.11	0.11	0.11	0.18	0.16
Postocellar area	0.28×0.50	0.30×0.48	0.25×0.43	0.41×0.83	0.30×0.66
Flagellomeres					
1 (height)	0.55 (0.14)	0.54 (0.14)	0.60 (0.17)	0.91 (0.16)	0.91 (0.16, 0.23 <sup>4</sup> )
2–6	0.60, 0.55, 0.47, 0.40, 0.39	0.62, 0.55, 0.47, 0.43, 0.37	0.74, 0.70, 0.60, 0.55, 0.52	1.07, 0.98, 0.80, 0.77, 0.69	1.12, 1.00, 0.80, 0.79 0.78
7 (height)	0.40 (0.09)	0.40 (0.10)	0.53 (0.10)	0.63 (0.07)	0.64 (0.07)
total	3.36	3.38	4.24	5.85	6.04
Hind femur with					
trochantellus	1.62	1.57	1.40	2.05	1.54
height	0.40	0.39	0.34	0.50	0.35
Hind tibia	2.01	1.94	1.75	2.60	1.82
Apical width	0.23	0.25	0.21	0.31	0.25
Inner hind spur	0.20	0.22	0.20	0.33	0.30
Outer spur	0.16	0.15	0.18	0.26	0.26
Hind tarsomeres					
1–5	0.61, 0.27, 0.21, 0.13, 0.35	0.59, 0.25, 0.20, 0.11, 0.32	0.64, 0.30, 0.25, 0.14, 0.33	0.60, 0.43, 0.30, 0.14, 0.55	0.54, 0.34, 0.21, 0.10, 0.41
total	1.57	1.47	1.66	2.02	1.60
Hind claw	0.18	0.17	0.15	0.25	0.17
Ovipositor sheat	1.32	1.35		1.65	
Sawsheat	0.90×0.25	0.85×0.25		0.84×0.20	
Cercus	0.20×0.06	0.17×0.06		0.16×0.09	
Hypopygium			1.30×0.94		1.83×1.11

1) Reared from larva on *Populus tremula* in 1958 by O. Ranin (coll. VV).

2) Reared from larva on *Populus tremula* in 1966 (leg. & coll. VV).

3) POL: postocellar line as the distance between the inner margins of the lateral ocelli; OOL: ocello-ocular line as the distance between the outer margin of one lateral ocellus and the inner margin of the compound eye of the same side; OD: ocellar diameter as the maximum width of one lateral ocellus.

4) On basal nodus.