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Ecology, morphology and distribution of *Ptilocolepus granulatus* (PICTET 1834) (Insecta: Trichoptera) in Austria

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With 4 figures and 1 table

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The distribution of *Ptilocolepus granulatus* (PICTET 1834) in the federal states of Austria is figured and some zoogeographical notes and the phenology of this species are included. In addition, information on larval ecology, abiotic parameters of the breeding sites and vertical distribution patterns in Austria are given, and morphological pros and cons for the taxonomical status of *P. granulatus* in families Glossosomatidae versus Hydroptilidae are briefly discussed.

1 Introduction

The subfamily Ptilocolepinae is classified either among the Hydroptilidae (e.g. BOTOSANEANU & LEVANIDOVA 1987, MARSHALL 1979, SCHMID 1998, WIGGINS 1996) or the Glossosomatidae (MALICKY 1983a, 1999). The subfamily consists of two genera: *Palaeagapetus*, which is known from Baltic amber, the Nearctic (two species), eastern Asia (one species) and Japan (five species), and *Ptilocolepus*, containing six extant Palaearctic species (ITO 1998, MALICKY & CHANTARAMONGKOL 1996, MARSHALL 1979, SCHMID 1990). *Ptilocolepus granulatus* (PICTET 1834) is the only representative of its genus in Austria (MALICKY 1999), with the other European Ptilocolepinae being restricted to the Caucasus and northern Iran (*P. colchicus* MARTYNOV 1913), the Caucasus (*P. dilatatus* MARTYNOV 1913) and to the Iberian peninsula (*P. extensus* McLACHLAN 1884). Whereas most taxonomists consider *P. dilatatus* as species, it is seen as subspecies of *P. granulatus* by other workers (e.g. MALICKY 1983a). The two remaining *Ptilocolepus* species have been described from India (*P. atiloma* SCHMID 1990) and Thailand (*Ptilocolepus nam-nao* MALICKY & CHANTARAMONGKOL 1996). In this paper the distribution of *P. granulatus* in Austria is briefly discussed and information on its ecology is presented. In addition we summarize morphological features which might be helpful in the discussion on family allocation of Ptilocolepinae.

2 Geographical distribution

The geographical distribution of *P. granulatus* in Europe ranges from southern Italy to northern Jutland and from the Pyrenées to the Carpathians (CASPER & al. 1977, CIANFICIONI 2000, JAQUEMART & COINEAU 1962, MALICKY 1983a, b, 1999, MEY & al. 1979, NOVAK & OBR 1977, ROBERT 2001, SCHRANKEL & al. 2002, STROOT 1984, TOBIAS 1964, TOBIAS 1986, WIBERG-LARSEN & al. 1991). In Germany, *P. granulatus* is known from all federal states except Saarland, Schleswig-Holstein and Mecklenburg-Vorpommern (ROBERT 2001). In Austria, this species is reported from all federal states except Burgenland (MALICKY 1999), although more recent recordings (1970- 2001) were made in Vorarlberg, Tyrol, Carinthia, Styria and Lower Austria only (Fig. 1).

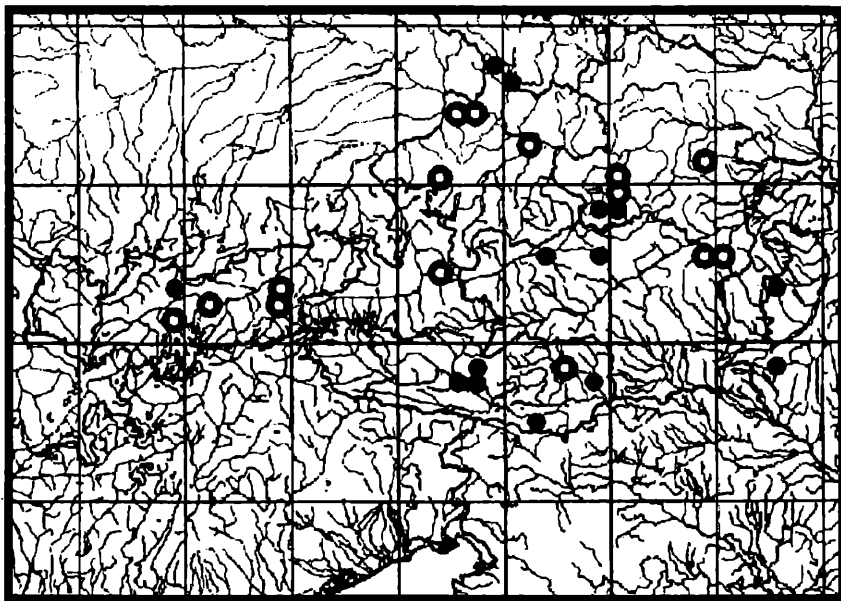


Fig. 1: Distribution of *Ptilocolopus granulatus* in Austria. Black dots: records from 1970 onwards; open circles: records before 1970. Courtesy Zobodat Linz with additions. Additional records of *P. granulatus* in Vorarlberg are given by MALICKY (1999) but have not yet been included in the map above.

3 Ecology

P. granulatus is a distinctly crenophilic species of montane to subalpine regions in central Europe (GRAF & al. 1995, ROBERT 1996, FISCHER 1996, ITO 1998). DITTMAR (1955) regards this species to be associated with *Fontinalis antipyretica*. In

contrast, ITO & HIGLER (1993) as well as DEPISCH (1999) mention the liverwort *Scapania undulata* (Family Scapaniaceae) to be the main feeding habitat as well as resource for case-building activities. *Scapania undulata* seems to prefer acidic montane to alpine brooks and groundwater-fed fens, which coincides quite well with the habitats of *P. granulatus*. Due to its robust mandibles *P. granulatus* is the only species of the subfamily Ptilocolepinae which is able to feed on *Fontinalis* sp. besides other bryophytes (ITO 1998). Maximum annual water temperatures at three springs in Carinthia and Lower Austria where the species was abundant were 4 to 8.5 °C with hardness values ranging from 1 to 3 German degrees. Other Trichoptera species observed at these locations were *Rhyacophila glareosa* MCLACHLAN, *R. hirticornis* MCLACHLAN, *R. laevis* PICTET, *R. producta* MCLACHLAN, *R. pubescens* PICTET, *R. stigmatica* KOLENATI, *R. tristis* PICTET, *Agapetus fuscipes* CURTIS, *Synagapetus iridipennis* MCLACHLAN, *Plectrocnemia conspersa* (CURTIS), *P. geniculata* MCLACHLAN, *Philopotamus ludificatus* MCLACHLAN, *P. montanus* (DONOVAN), *Wormaldia copiosa* MCLACHLAN, *W. occipitalis* (PICTET), *Tinodes dives* (PICTET), *Drusus chrysotus* (RAMBUR), *D. destitutus* (KOLENATI), *D. monticola* MCLACHLAN, *Allogamus uncatu*s (BRAUER), *Chaetopteryx fusca* BRAUER, *C. major* MCLACHLAN, *C. rugulosa* KOLENATI, *Chaetopterygopsis maclachlani* STEIN, *Halesus rubricollis* (PICTET), *Leptotaulius gracilis* SCHMID, *Parachiona pici-cornis* (PICTET), *Potamophylax cingulatus* (STEPHENS), *P. nigricornis* (PICTET), *Pseudopsiloptyx zimmeri* (MCLACHLAN), *Lithax niger* (Hagen), *Crunoecia irrorata* (CURTIS), *C. kempnyi* MORTON, *Beraea pullata* (CURTIS), *Ernodes articularis* (PICTET), *E. vicinus* (MCLACHLAN) and *Sericostoma personatum* KIRBY & SPENCE. The life cycle appears to be univoltine (ITO & HIGLER 1993) with facultative semivoltinism. In Ardennes springbrooks the flight period lasts from March to April with a second emergence in autumn. Our records of adults of *P. granulatus* from Austria (Lower Austria, Styria and Carinthia) are dated from May and June. In Austria, *P. granulatus* has been recorded from as low as 200 m a.s.l. up to 1800 m a.s.l. (data courtesy Zobodat, Linz).

4 Taxonomical status

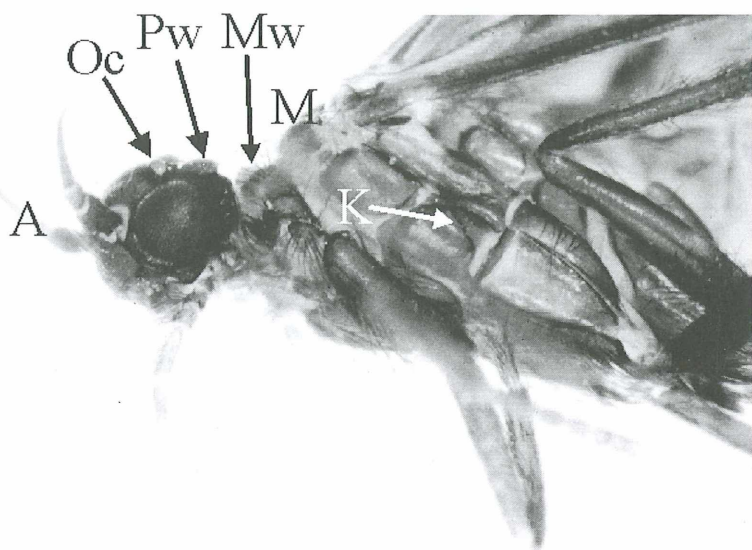
Based on larval and pupal morphology (THIENEMANN 1904a, b) as well as on hypermetamorphosis (NIELSEN 1948), the subfamily Ptilocolepinae is widely regarded as primitive hydroptilid. In the adult, the shape and venation of the partly pubescent wings and the prominent sternal glands, among others, reflect the morphological basic status of this subfamily. On the other hand, MARSHALL (1979) clearly stated that there are marked differences between the two hydroptilid subfamilies Hydroptilinae and Ptilocolepinae. The latter also resemble small glossosomatids and are classified among this family by some workers. Table 1 and figures 2-4 summarize morphological characters illustrating this inter-

mediate status of Ptilocolepinae. Based on larvae, *Ptilocolepus* clearly is a hydroptilid; based on adult morphology, the taxon shares many features typical for Glossosomatidae. This is why MALICKY (2001) recently suggested to raise the subfamily Ptilocolepinae to family rank Ptilocolepidae.

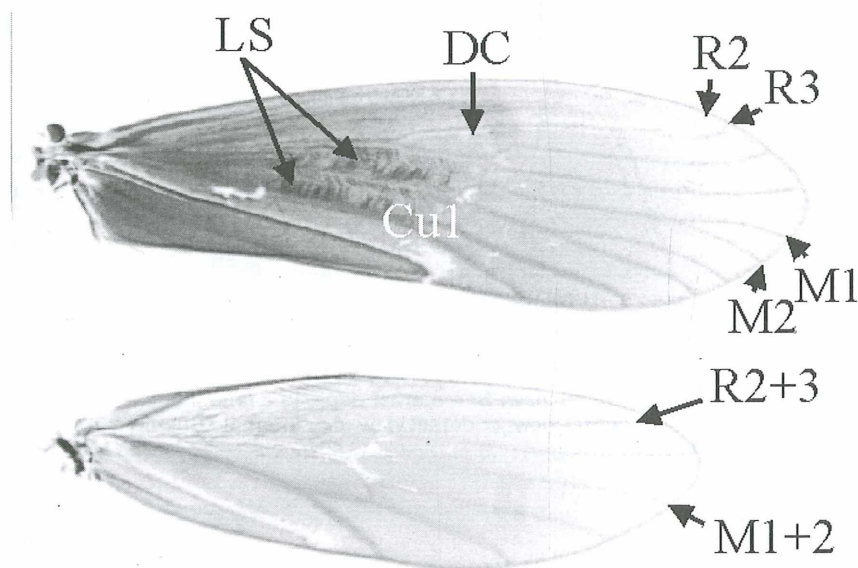
Tab. 1: Selected morphological characters of adult and larval Ptilocolepinae illustrating the intermediate status of this subfamily between Glossosomatidae and Hydroptilidae

Character	Pro Glossosomatidae	Pro Hydroptilidae
Wing venation well developed	+	
Discoidal cell present		
Forewing: Cu1 forked		
Forewing: M3 and M4 separated		
Posterior mesothoracic katapisternal suture present		
Fifth abdominal segment with sternal ridge		
Spur formula 1-3-4 (as in Stactobiella)		
Postoccipital warts large, meeting medially		
Pronotal median warts close-set		
Larval case purse-shaped		
Hypermetamorphosis sensu NIELSEN (1948) present		+

Fig. 2. a: Head and thorax of a male of *P. granulatus*. Oc = lateral pair of ocelli situated close to the compound eyes, A = antennae, Pw = large, ovoid postoccipital warts meeting medially, M = mesonotum, Mw = median warts, K = katapisternal suture. **b:** Right fore and hind wing of a male of *P. granulatus*. DC = closed discoidal cell, LS = two rows of long setae bordering the median and thyridium cell; R2 and R3 and M1 and M2 are separated in the fore wing, fused in the hind wing; Cu1 is forked



2a



2b

4

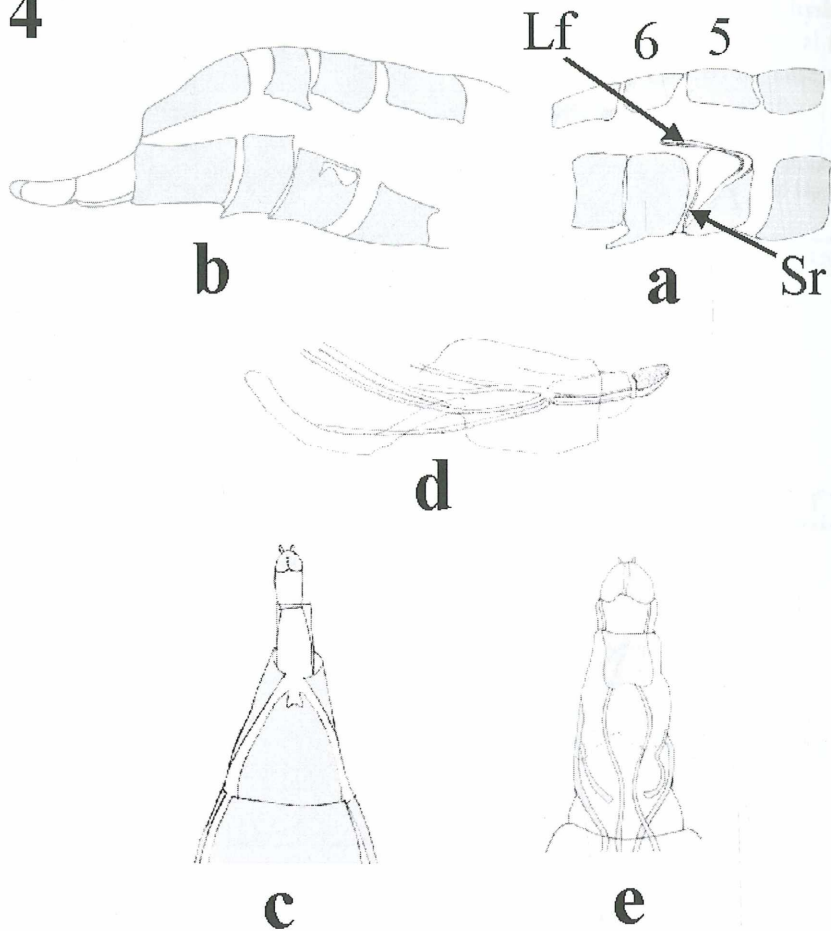


Fig. 4. a: Male abdomen, lateral view; Sr = sternal ridge, Lf = lateral filament. b-e: Details of oviscapt. b: right lateral view. c: dorsal view. d-e: internal structures in d: right lateral and e: dorsal view

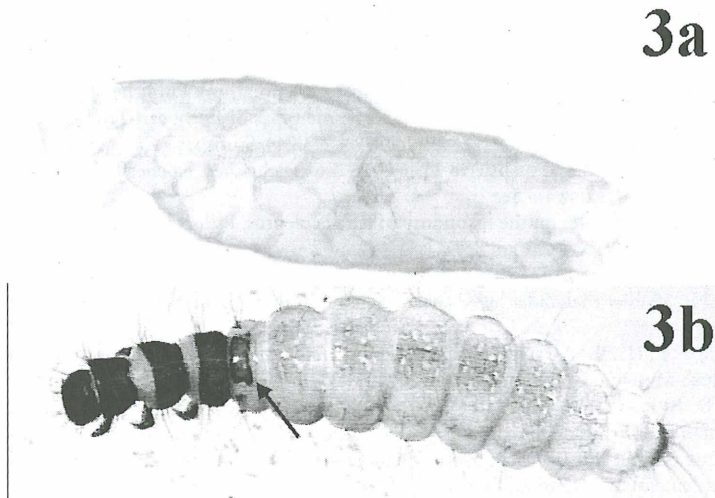


Fig. 3. a: Purse-type case of *P. granulatus* constructed of moss leaves. b: Final instar larva. Arrow: sclerotized first abdominal dorsum

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