Australachalcus japonicus sp. n., the first record of an achalcine species from Japan (Diptera: Dolichopodidae, Achalcinae)

By Marc POLLET & Andreas STARK

Abstract

A new dolichopodid species, *Australachalcus japonicus,* is described here for the first time. Its discovery represents the first record of an achalcine species in Japan and even the entire Eastern Palaearctic. Together with the European *Australachalcus melanotrichus* (MIK) it constitutes the *Australachalcus melanotrichus* species group with no current representatives in the New World. In contrast with 19 other *Achalcus* and *Australachalcus* species with both sexes described, *A. japonicus* shows a strong basoventral bristle on femur I in both male and female. This common character in Palaearctic and New World *Achalcus* and *Australachalcus* was thus far considered a Male Secondary Sexual Character. It is assumed that, like *A. melanotrichus*, this species breeds in rotholes of living deciduous trees.

Key words: *Australachalcus*, *Achalcus*, Dolichopodidae, Japan, ecology

Samenvatting

Een nieuwe slankpootvliegensoort, *Australachalcus japonicus*, wordt hier voor het eerst beschreven. Dit is meteen de eerste melding van een vertegenwoordiger uit de subfamilie Achalcinae uit Japan en zelfs het volledig, oostelijk deel van het Palaearktische rijk. Samen met de Europese *Australachalcus melanotrichus* (MIK) vormt deze nieuwe soort de *A. melanotrichus* soortengroep die tot hier toe geen Neotropische vertegenwoordigers omvat. In tegenstelling tot 19 andere *Achalcus*- en *Australachalcus*-soorten waarvan beide sexen werden beschreven, vertoont zowel het mannetje als het wijfje van *A. japonicus* een basoventrale stekel op femur I. Dit is des te merkwaardiger daar dit kenmerk, dat frekwent wordt aangetroffen bij soorten van beide genera uit het Palaearctische Rijk en de Nieuwe Wereld, tot hier toe als een strikt secundair mannelijk geslachtskenmerk werd beschouwd. Er wordt aangenomen dat, net als bij de zustersoort *A. melanotrichus*, de larven van *A. japonicus* zich ontwikkelen in houtmolm van vochtige boomholten.

Sleutelwoorden: *Australachalcus*, *Achalcus*, Dolichopodidae, Japan, ecologie

Introduction

In the Palaearctic, the subfamily Achalcinae (Diptera: Dolichopodidae) comprises only 9 representatives with 8 *Achalcus* Loew and 1 *Australachalcus* POLLET species (POLLET, 1996, 2005) and thus accounts for only 1.1% of the European dolichopodid fauna. With 5 named, 6 unnamed (POLLET & CUMMING, 1998), and three species that await description (POLLET, unpubl. data) appears the North American fauna slightly richer in species but even in the Neotropical realm with a considerably richer achalcine fauna, this subfamily represents only a minority of the dolichopodid diversity. Most probably very strict habitat requirements are responsible for the usual rarity of the species. In fact, recent large scale inventories revealed that most species in the Holarctic region are highly hygrophilous and seem to favour reed marshes (Europe), marshlands (Europe, North America) (POLLET, 1992) and coastal deciduous forests (western North America) (POLLET & CUMMING, 1998). Detailed information on the biology in general and the larval habitats and development in particular (except for *Australachalcus melanotrichus* (MIK)) is, however, still almost entirely lacking.

Whereas more new achalcine species can readily be expected in the largely undersampled Nearctic realm, this is rather unlikely in the western part of the Palaearctic (Europe). Indeed, since the *Achalcus* revision by POLLET (1996) and despite the continued sampling efforts, the European achalcine fauna has not been extended during the past 8 years. The eastern Palaearctic, on the contrary, remains largely, if not entirely, unexplored. In this respect, in June 2002 NEGROBOV (pers. comm.) informed me of a new species from the Amur region the description of which, unfortunately, has not been published yet. Nevertheless, the recent discovery of a new achalcine species and, moreover, a representative of *Australachalcus* in Japan remains surprising. In the present paper, this species, *Australachalcus japonicus* sp. n., is described and its morphology, phylogenetic relationship to related species in Europe, and its biology and ecology are discussed.

Material and methods

Specimens were collected exclusively by Dr. MATHIAS JASCHHOF (Zoological Institute and Museum, University of Greifswald, Greifswald, Germany) and CATRIN JASCHHOF during their 8 weeks research stay in Japan in 1999 at the Forestry and Forest Products Research Institute in Tsukuba. The examined specimens make part of a larger collection of dolichopodid samples gathered during a large scale inventory in Japan (1998-2000). These

samples were consequently provided to, and are currently stored in the personal empidoid collection of the junior author. The above mentioned survey that basically focused on the taxonomy of Japanese wood midges (Cecidomyiidae: Lestremiinae) involved extensive collecting by Malaise traps on all major Japanese islands during the entire season. Main collecting sites included mature forests, but other types of wooded habitats were occasionally sampled as well.

Biometric measurements were carried out on specimens stored in 70% alcohol solution, following POLLET (1996) and POLLET & CUMMING (1998). The CuA_x ratio (BICKEL, 1994) is the ratio of the apical section of vein CuA_1 vs the outer crossvein (m-cu or tp). In addition, also the ratio of the proximal vs the apical section of vein M_{1+2} was calculated. In the male, body and wing size is based on 11 and 12 specimens resp. and vein ratios on 7 specimens. Antennal ratios were measured in one mounted male and one female specimen. The scale used in Figs. 1-12 is in mm.

Terms used in the male genitalia (Figs. 6-12) follow CUMMING *et al.* (1995) and POLLET & CUMMING (1998) in case of *Achalcus*.

Collector and collection abbreviations: BMNH – The Natural History Museum, London, UK; CNC – Canadian Collection of Insects, Ottawa, Canada; ISNB – Royal Belgian Institute of Natural Sciences; KUEC – Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan; POLLET – personal collection of the senior author, Denderhoutem, Belgium; STARK – personal collection of junior author, Halle/S., Germany; USNM – National Museum of Natural History, Washington D.C., USA.

Morphological abbreviations: ac – acrostichal bristle(s), ad – anterodorsal, av – anteroventral, dc – dorsocentral bristle(s), DEP – dorsal process of epandrium, MSSC – male secondary sexual character, pd – posterodorsal, PGO – postgonites, ps – presutural, pv – posteroventral, VEP – ventral process of epandrium.

Description

Australachalcus japonicus sp. n.

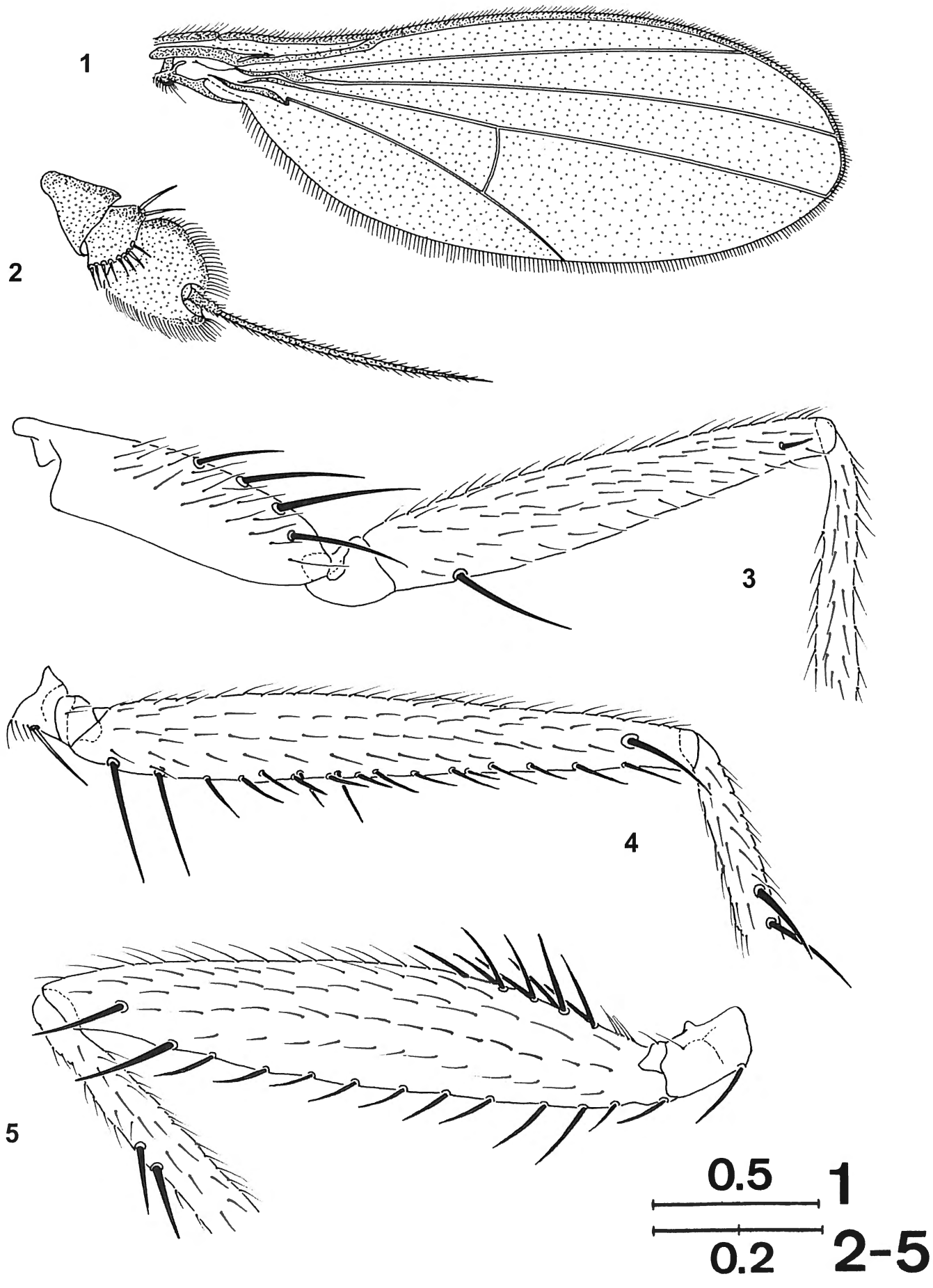
Small, rather slender, dark species with black bristles and pubescence (Fig. 13). **Male. Head.** Face brown, narrow, about as wide as central ocellus. Frons dark brown. Occiput convex, with slight central dorsal concavity, dark brown, shining. Postocular bristles all dark. Palp ovoid, small, about 1/5 of eye, pale yellow; with dark pubescence, and 1 strong dark apical bristle. Antenna (Fig. 2) dark with scape and pedicel yellowish brown, especially on inner face, and 1st flagellomere dark brown; latter triangular, 1.2x as long as deep en 0.9x as long as scape and pedicel combined. Arista 1.4x as long as first three antennal joints, subapical, with short pubescence.

Thorax. Mesonotum including scutellum blackish brown with pleura and postnotum dark brown; postnotum with distinct black frontolateral spot. Metapleura mainly dark brown with lower 1/5 whitish yellow. 7 ac, biserial, more than 2x as long as distance between rows. 6 dc. One large (ac-sized) sutural bristle present. About 8 small bristles present between 3rd dc, ps and sutural bristles. Upper propleura bare, lower propleura with 2 to 3 minute dark setae; with one prothoracic bristle. **Abdomen** with 6 pubescent segments. Abdominal tergites and sternites entirely dark brown with genital capsule yellowish brown. **Hypopygium** (Fig. 6) with hypandrium (Fig. 7) with apical up-left margin and blunt knobs on ventral surface near apex; phallus (Fig. 8) smoothly curved, with small subapical dorsal process; epandrial setae inserted at base of epandrial lobe (Fig. 9); ventral bristle of surstylus with distinct apical palette (Fig. 10); VEP apparently absent; DEP present; postgonites (Fig. 11) distinct, slender, reddish yellow; cercus (Fig. 12) small, with strong apical bristle, elongate triangular.

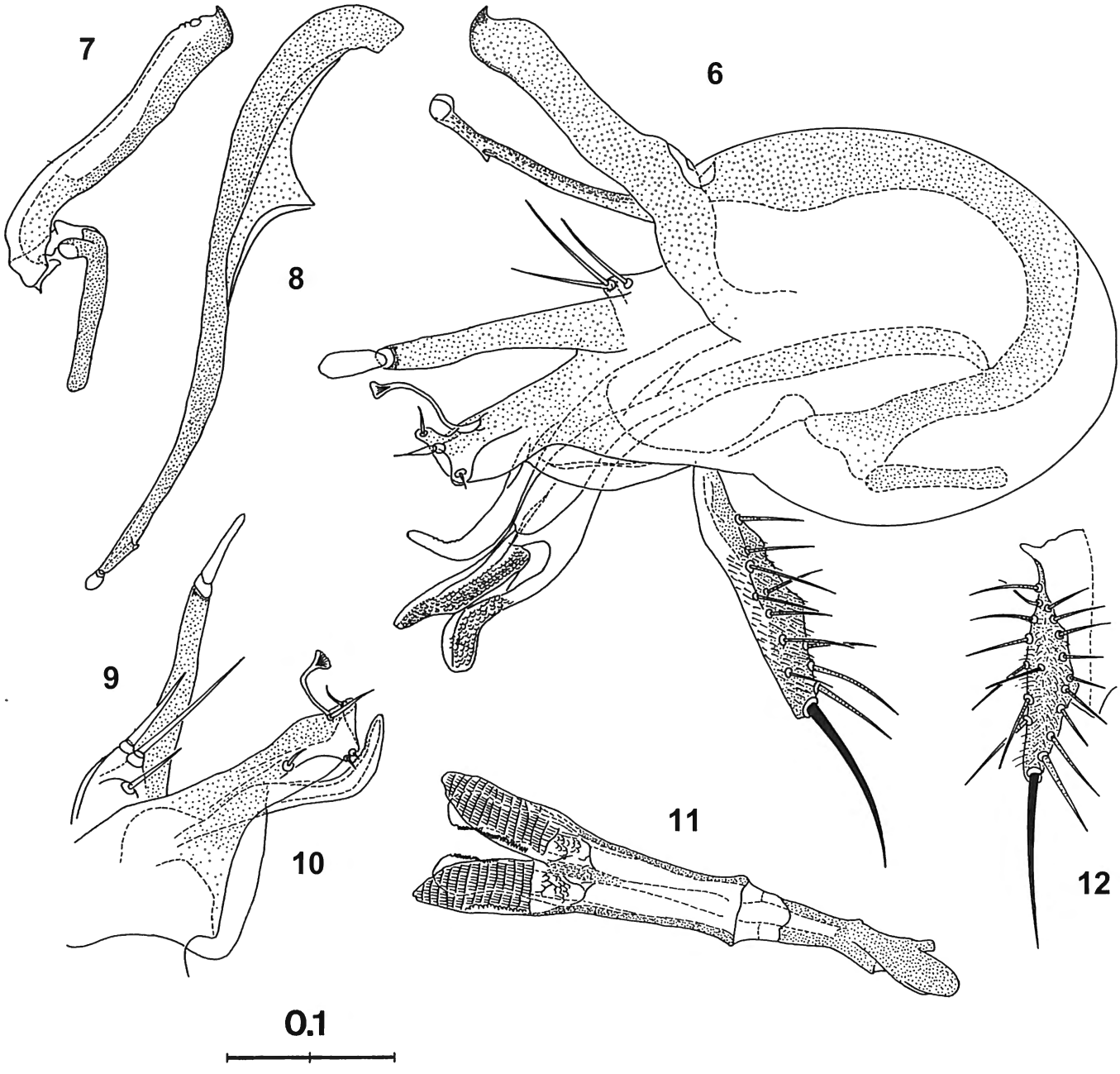
Wing. Halter pale, squama dark. Wing (Fig. 1) slightly darkened, 2.8x as long as wide, with veins R_{4+5} and M_{1+2} diverging towards wing apex. Proximal section of vein M_{1+2} 0.8x as long as apical section; proximal section of vein CuA_1 2.0x as long as apical section; CuA_x ratio 1.7. Wing length 2.0-2.3 mm.

Legs including coxae and tarsi almost entirely whitish yellow. Coxa I only infuscated at extreme base, coxa II with dark outer spot, and leg III pale yellow. Coxa III with one erect dark bristle at about middle. Femur I (Fig. 3) with strong erect ventral bristle at about basal 1/5, 1.5x as long as femur is deep and followed by row of short av bristles. Femur II (Fig. 4) with 1 strong ad preapical bristle; with 2-5 erect strong ventral bristles on less than basal 1/4, most basal bristles 1.4x as long as femur is deep; followed by small inclined ventral bristles with apical ones stronger. Femur III (Fig. 5) with 1 strong ad preapical bristle inserted at lower 1/3 of anterior face, and with 1-2 strong av preapical bristles; with 1 strong erect ventral bristle at about basal 1/6, as long as femur is deep, followed by row of rather small inclined ventral bristles; with row of erect basodorsal bristles on less than basal 1/3. Tibia I without dorsal bristles; tibia II with 2 ad and 1 pd bristles; tibia III with 2 ad and 3 pd bristles, and one row of erect pd bristles on less than apical 1/2; with 3-4 small erect setae among dense ventral pubescence, mainly in basal 1/2. Metatarsus II with 1 pv bristle at about basal 1/4, longer than tarsomere is deep. Metatarsus III 0.8x as long as 2nd tarsomere. Body length 2.0-2.4 mm.

Female. As in male, except for the following: face wider, about 1.5x as wide as large central ocellus. Palp kidney-shaped, about 1/3 of eye, yellow. Antenna with 1st flagellomere subcircular with distinct apex; 1st flagellomere as long as deep and 0.8x as long as scape and pedicel combined. Arista 2.8x as long as first three antennal joints, apical. Abdomen (also with 6 pubescent segments) with 8th segment showing 8 reddish brown spines and 2 cerci. Wing with proximal section of M_{1+2} 0.9x as long as apical section; proximal section of vein



Figs. 1-5 — *Australachalcus japonicus* sp. n. (male paratype). 1, wing; 2, antenna; 3, coxa and femur I; 4, femur II; 5, femur III.



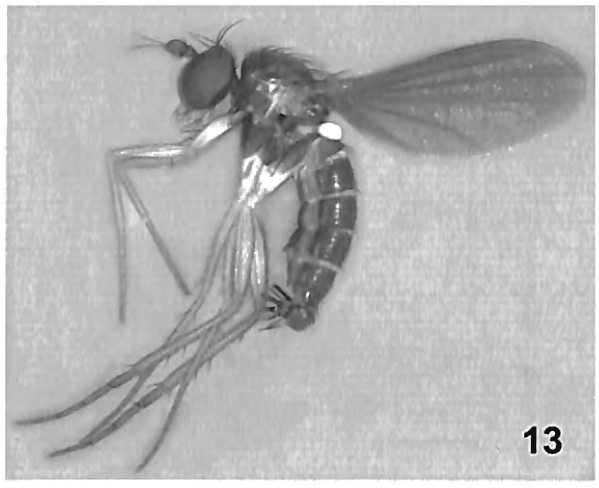
Figs. 6-12 — *Australachalcus japonicus* sp. n.. (male paratype). 6, hypopygium; 7, hypandrium and hypandrial arm; 8, phallus; 9, right epandrial lobe and setae; 10, right surstylus and ventral process of epandrium (VEP); 11, postgonites (dorsal view); 12, right cercus (lateral view).

CuA_1 3.0x as long as apical section; CuA_x ratio 1.2. Femur I with basoventral bristle at about basal 1/5, about as long as femur is deep, and followed by a row of short av bristles. Femur II and III without strong ventral bristles beyond normal pubescence. Body length 3.0 mm, wing length 2.6 mm.

ETYMOLOGY. The species has been named after the country (Japan) where it has first and thus far exclusively been found.

HOLOTYPE. 1 ♂, JAPAN, Honshu, Aomori Pref., Towada-ko Town, Tsuta Onsen, primary mixed deciduous forest (*Fagus crenata*, see Fig. 14) (locality catalogue no. 106), 500-600 m, 25.vi.-28.vii.1999, Malaise trap, leg. M. JASCHHOF (KUEC; in 70% alcohol solution).

OTHER PARATYPES. JAPAN: 13 ♂♂, 2 ♀♀, same data as holotype; 1 ♂, Hokkaido, Furano City, Rokugo Village, Tokyo University Experimental Forest, primary mixed deciduous – coniferous forest (*Abies sachaliniensis*) with



Figs. 13-14 — 13, general habitus of *Australachalcus japonicus* sp. n. (male paratype). 14, mature mixed deciduous forest in Japan (Honshu, Ibaraki Prefecture, Abukuma Highland, Kitaibaraki City, Sadanami, Ogawa Forest, 600-700 m), preferred habitat of *Australachalcus japonicus* sp. n.. This habitat is very similar to the type locality at Tsuta Onsen regarding tree species composition, altitude, and maturity.

Sasa sp. (locality catalogue no. 114), 400-500 m, 05-23.vii.1999, Malaise trap, leg. M. JASCHHOF (BMNH, CNC, ISNB, KUEC, POLLET, STARK, USNM; provided by the senior author in 70% alcohol solution).

Discussion

In the Palaearctic realm, *Australachalcus melanotrichus* (MIK, 1878) is the only relative of *A. japonicus*. Both species clearly belong to *Australachalcus* on the basis of e.g. 6 dc bristles, the epandrial setae inserted at the base of the epandrial lobe and the midventral bristle of the surstylus with a terminal enlargement. They do not fit any of the Neotropical species groups defined by POLLET (2005), but represent a separate new one, the *A. melanotrichus* species group, characterized by the presence of a subapical process on the aedeagus (synapomorphy) and a small, triangular cercus with a strong apical bristle. Further on, both species share the same general habitus with an entirely dark body, a large central ocellus and a hypopygium with distinct appendages. Among Palaearctic Achalcinae, *A. melanotrichus* and *A. japonicus* further differ from the other species in lacking dorsal bristles on tibia I (vs 1 in *Achalcus*) in combination with only 2 ad bristles on tibia III (3 in most *Achalcus*).

Both sexes of *A. japonicus* can easily be separated from its European congener by the narrower wing (2.5x as long as wide in *A. melanotrichus*), the paler scape and pedicel (vs entirely black), and the entirely whitish yellow legs (vs strongly infuscated femur III and tibia III). Male *A. japonicus* can further be distinguished by the smaller 1st flagellomere (vs 1.7x as long as scape and pedicel combined), the presence of basoventral bristles on femur II and III, the stronger basoventral bristle on femur I, and the blunt knobs on the hypandrium (vs strongly spined hypandrium). Female *A. japonicus* show a basoventral bristle on femur I, that is absent in female *A. melanotrichus*. In fact, of 19 Palaearctic and New World achalcine species with male and female specimens available *A. japonicus* is the only species with a basoventral bristle on femur I in both sexes. This is very surprising as this feature was thus far considered a Male Secondary Sexual Character (MSSC) in this subfamily where it is rather common in *Achalcus* (in 15/21 species) and *Australachalcus* (in 12/13 species) (POLLET, 1996, 2004; POLLET & CUMMING, 1998).

Australachalcus melanotrichus is recorded from most of Europe (France, Ireland, Great Brittain, The Netherlands, Belgium, Germany, Sweden, Norway, Austria, the Czech Republic, Italy, Hungary, Romania) but seems to be absent in the Mediterranean bassin, which also holds true for all 8 European species of the related genus *Achalcus*. North Italy seems to be the southernmost limit of the distribution areas of both *Achalcus cinereus* and *A. flavicollis* (PESARINI *et al.*, 1995). As stated by POLLET (1996), the biology and habitat affinity of *A. melanotrichus* clearly differs from that of Palaearctic *Achalcus* species in that its larvae breed in rotholes of living deciduous trees. Thus far, birch (*Betula* sp.), beech (*Fagus* sp.), elm (*Ulmus* sp.), horse chestnut (*Aesculus hippocastanum*), lime tree (*Tilia* sp.), oak (*Quercus robur*) and poplar (*Populus* sp.) have been listed as host trees in the literature (see POLLET, 1996).

Like *Systenus* species (Dolichopodidae, Medeterinae), adult *A. melanotrichus* are hardly encountered in the field, but instead mostly reared from collected wet wood debris. None of the numerous Malaise traps that were in operation in Belgium between the early 1980's and 2003 yielded a single specimen of this species. All recent collections were exclusively made by visual inspection of rotholes, the sweeping of tree trunks and with green pan traps. Indeed, the latter traps, installed at about 1 m height, proved successful on several occasions, although

very limited numbers were collected (POLLET, unpubl. data). Pan traps of this colour and blue versions in general seem to attract mainly arboreal Dolichopodid species like *Sciapus* sp., *Medetera* sp. and *Neurigona* sp. (POLLET & GROOTAERT, 1987, 1994), which, again, confirms the arboreal biology of *A. melanotrichus*. In this respect, DIESTELHORST & LUNAU (2001) trapped no less than 42 specimens of 5 *Systenus* species – which represent all species of this genus thus far recorded in Germany – with two black pan traps attached to the trunk of a single beech tree (*Fagus silvatica*) at a height of 9 m and 17 m in a forest in Bünde (Germany). In sharp contrast, yellow, UV-white and white traps of the same size and installed on the same tree merely yielded 1, 2 and 2 *Systenus* specimens resp.. No *A. melanotrichus* specimens were observed in this inventory. However, this might be explained by the rather late trapping period from mid July until the end of September as *A. melanotrichus* reaches its activity peak during June.

Australachalcus melanotrichus was first recorded from Belgium as late as 1994 (POLLET, 2000) but has subsequently been collected in another 3 Flemish (northern Belgium) and 1 Wallonian locality (southern Belgium) (POLLET, unpubl. data). POLLET (2000) considers it as very rare in Flanders purely on the basis of its occurrence in only 1.2% of the 167 5km UTM squares sampled since 1981. However, as he indicates that the species was encountered both in mature forests and on separate trees outside forests, this apparent rarity seems to be mainly explained by its special biology. Indeed, specimens that were collected by hand in the field usually tend to remain in the rothole microhabitat itself before they were forced out by the senior author. In this context, the considerably larger size of the central ocellus – as compared to Palaearctic *Achalcus* species – might indicate a life in conditions of permanent low light intensity. However, it remains unclear how the species actually disperses although it can be assumed that during ideal (relatively warm, humid, dark) weather conditions *A. melanotrichus* (as *Systenus* species) leaves the rothole where it accomplished its larval development in search for other suitable microhabitats. In this context, the senior author encountered two specimens on a wet moss covered base of an oak tree (*Quercus robur*) in an alley (De Pinte, Belgium), during sunny weather immediately after rainfall. The tree did not show any distinct sapruns nor rotholes. Also the junior author observed *A. melanotrichus* while flying at the base of old lime (*Tilia* sp.) and oak (*Quercus robur*) trees and displaying some kind of a searching behaviour. On these occasions, single flies were seen hovering at a short distance from, and flying upwards the tree trunks.

Since *A. japonicus* seems phylogenetically very closely related to the latter species and shares e.g. the large central ocellus, it can be assumed that it shows a similar way of life. It certainly seems to occur in mature forests and although the tree species composition at the two Japanese sites with *A. japonicus* is largely different, both represent fine examples of mature forests typical for their regional climate and soil conditions. Moreover, old forests of this kind seem to be far from common in today's Japan. Two and six Malaise traps were in operation for three to four weeks at the Hokkaido and Aomori site resp.. Traps were subsequently removed in the former site, but trapping continued for another four weeks at the latter site, however, without yielding any additional specimens. Unfortunately, due to the restrictions of the sampling campaign both in time and space, clear-cut zoogeographical distribution or seasonality patterns could not be retrieved from the available sample set. And although the unusual high abundance of *A. japonicus* at Tsuta Onsen (Aomori) remains largely unexplained, a short activity period, a restricted (northern) distribution range or a combination of both might be important factors.

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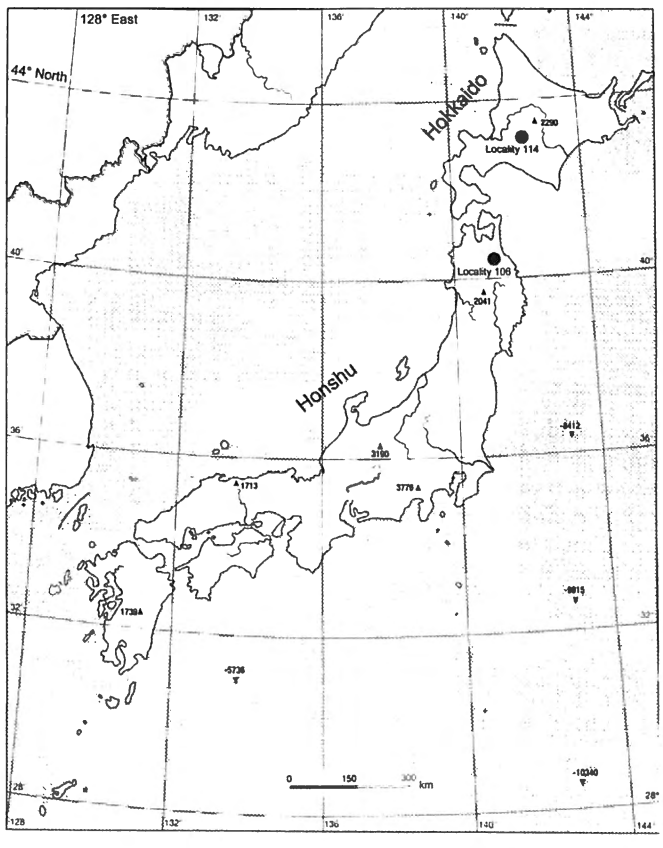

Fig. 15 — Type localities of *Australachalcus japonicus* sp. n. in Japan (indicated by black circles).

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