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High time for *omtanke*: New mycophagous gall midges (Diptera: Cecidomyiidae) from a floodplain forest in central Sweden threatened by continuous clear-felling

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Jaschhof, M. & Jaschhof, C.: High time for *omtanke*: New mycophagous gall midges (Diptera: Cecidomyiidae) from a floodplain forest in central Sweden threatened by continuous clear-felling. [**Hög tid för omtanke: Nya mykofaga gallmyggor (Diptera: Cecidomyiidae) från en svämskog i centrala Sverige hotade av pågående kalhyggesbruk.**] – Entomologisk Tidskrift 141 (4): 191–206. Björnlunda, Sweden 2020. ISSN 0013-886x.

Two species of mycophagous gall midges (Cecidomyiidae: Porricondylinae: Porricondylini) are described as new to science and named *Cassidoides bertanderssoni* **sp. nov.** and *Coccopsilis omtanke* **sp. nov.** Both were discovered in 2019 during a taxonomic inventory of mycophagous gall midges in Dalarna's Unnån valley, amply documented to be an area of extraordinary biological diversity. Other specimens collected during this survey represent the first Swedish records of the mycophagous cecidomyiids *Camptomyia regia* Spungis, 1989 and *Neurolyga interrupta* Jaschhof, 2009. The valley of Unnån, a non-straightened, fast-flowing river, is particularly remarkable for its jungle-like floodplain forest, of which extensive, largely unspoiled stretches have survived to the present day, and are shown here to host previously undescribed insect species. Unnån's ecosystem is, demonstrably and acutely, threatened by continuous clear-felling. In the authors' opinion such a loss of living environment for countless woodland organisms, many of which red-listed, is behind the times and inacceptable. Using the example of the Unnån, it is discussed here that new species descriptions should join other attempts to raise awareness of the intrinsic value of natural habitats, including old-growth forest, particularly on a local or regional scale. *Omtanke* (Swedish for consideration or concern) is highlighted as a genuinely Nordic principle, which is argued here to have the power to conciliate in, and finally help to resolve, the Unnån conflict, on condition that it is resolutely and relevantly implemented.

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Gall midges (Cecidomyiidae) are arguably the largest family of true flies (Diptera), with 6 500 species named (Gagné & Jaschhof 2017) and up to 2 million species suggested to be extant (Hebert *et al.* 2016). While the family is almost worldwide in distribution (unrecorded in Antarctica), the tropics are likely to host the majority of species (e.g. Brown *et al.* 2018). The family name hints, in all languages, to the fact that the larvae of most known phytophagous members (all classified in the subfamily Cecidomyiinae) induce living plants to abnormal growths referred to as galls: protuberances of varied shape and structure that provide larvae with food and shelter. There are also predacious and mycophagous cecidomyiids – a fact unknown even to many naturalists, entomologists included. While each of the six subfamilies recognized (Gagné & Jaschhof 2017) contains fungus-eaters, five subfamilies are regarded as universally mycophagous: Catotrichinae (absent in

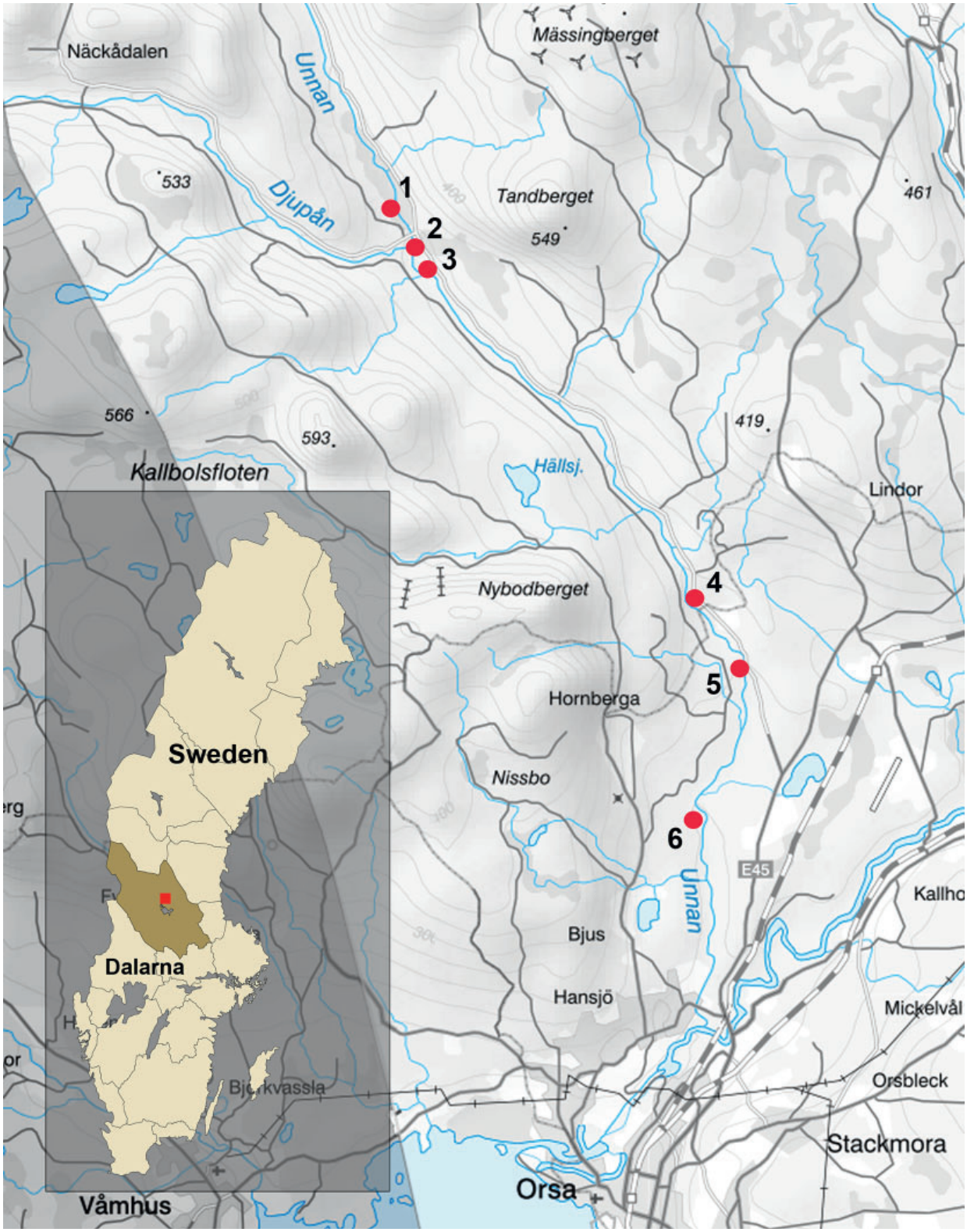

Figure 1. Location of the Unnån valley (red square in the inset) and positions of Malaise traps 1–6 (red circles) within the study area.

Figur 1. Placering av Unnåns dalgång (röd fyrkant i infällda kartan) och platser för Malaisefällor 1–6 inom studieområdet.

Europe), Lestremiinae, Micromyinae, Winnertziinae and Porricondylinae. It is generally assumed that mycophagous cecidomyiids are mycelium-eaters, but host specialization and other host-related aspects are poorly researched, as are other facets of a species' biology and life history. As a matter of fact, our knowledge of most of the named species is confined to the morphology of male adults, with larvae and females remaining unknown. Since only males are known to have morphological characters diagnostic of species, they are the objects preferred in taxonomic studies – a methodological peculiarity that separates specialists in the mycophagous subfamilies from other cecidomyiidologists.

While taxonomists studying phytophagous gall midges draw inferences from several sources (host plants; gall structure; all life stages, usually obtained by rearing; life history), students of mycophagous cecidomyiids are content with males caught in flight, for instance by Malaise trap or sweepnet. Admittedly, this contentness is forced by the circumstance that the larvae of mycophages move about freely in or on fungus-infested substrates (like plant debris and soil) and thus are harder to locate in nature.

Thanks to The Swedish Taxonomy Initiative, *Svenska Artprojektet*, the taxonomy of mycophagous cecidomyiids in Sweden is more thoroughly studied than in any other country in Europe and the World (a detailed account of this research in Entomologisk Tidskrift is forthcoming, see Jaschhof & Jaschhof, in prep.). Three taxonomic inventories conducted by the authors in the past 15 years discovered as many as 438 species new to science, of which 274 were previously described and named, and two are published in the present paper: *Cassidoides bertanderssoni* sp. nov. and *Coccopsilis omtanke* sp. nov. Both were collected in 2019 along the banks of the small river Unnån, located north of Orsa in Dalarna (Fig. 1).

According to a recently published, very informative documentation, *Svämskogar vid Unnån i Orsa* [The floodplain forests at the Unnån in Orsa], naturalists are for a long time aware of the extraordinary biological diversity of the Unnån valley. This circumstance prompted the regional nature protection agency as long ago as 30 years to assign the area the rating as *högsta skyddsklass* (highest level of protection value) (Turander *et al.* 2018). The natural vegetation of the valley is boreal forest, although the area is rich in remnants of sparse population and modest land use by humans for ages. This includes abandoned meadows, now in various stages of succession (overgrowing), which add to the small-scale mosaic-structure of habitats characteristic especially of the lower, less steep parts of the valley. For most of the year the Unnån is a fast-flowing and shallow stream of modest width (Fig. 2), but it can become impressively forceful after strong rainfalls in its drainage area, as well as during the snow melting period in April/May, when the forest along both river banks becomes flooded and, for shorter periods, packed with ice floes that get stuck between the trees. The resulting floodplain forest is, naturally, a periodically changing environment, which offers year by year ever new opportunities for upcoming pioneer vegetation. Mature trees manage to survive waterlogging and mechanical damage by blocks of ice, although receiving deep scars (Fig. 3). Needless to say, it is unresearched how mycophagous gall midges are adapted to this kind of harsh biotope. The Unnån, whose incline is 700–200 m elevation on a distance of 40 km, is located only a few kilometers north of Orsa, a small town of some 5 000 inhabitants. Another small town in the vicinity is Mora, at the famous Lake Siljan, a popular tourist attraction. The valley of Unnån is visited by amateur fishermen, hunters, forest enthusiasts, hikers, owners of summer houses, and naturalists, all in modest numbers. A source of substantial disturbance of the ecosystem's natural processes is nowadays the practices of what is often referred to as modern forestry, with modern not necessarily meaning something conducive for the living environment of countless species of forest-dwelling organisms. We have reason to expand on this later on.

The primary motivation to write this paper was to present morpho-taxonomic descriptions of the two new species discovered in Unnån's flood-plain forest in 2019. As the morphology of these species is rather unspectacular, and their biology was not a target of our study, those aspects are only sparsely discussed here. Discussed in greater detail are subjects that, usually, are no topic of taxonomic-descriptive papers: the role of taxonomy in society and the possible impact of new species descriptions for nature conservation and environmental education. This peculiarity originates from the circumstance that, obviously, the habitat of our new species is imminently threatened by destruction.

Figure 2. A peaceful Unnån river in early summer (28 June 2018) between trap sites 4 and 5. Photo: M. Jaschhof.

Figur 2. En stilla Unnån under tidig sommar (28:e juni, 2018) mellan platserna för fälla 4 och 5. Foto: M. Jaschhof.

Material and methods

To collect mycophagous gall midges, we have visited Dalarna on several occasions, first in 1996 and last in 2018/2019. The aim of our collecting campaigns was always to obtain specimens for taxonomic study, i.e. the focus was on collecting as much as possible material of as many as possible different species – primarily species new to the country or new to science. At no point we attempted to design our collecting protocol in such a way that data could later be used for documenting any trends (in population size and composition, for instance) over time. Even so, as we traveled alert-eyed, and eager to experience as much as possible of the region's nature, we witnessed the process that was recently described as an unprecedented decline phase of Dalarna's forest landscape, brought about by forestry practices, which do not flinch from leaving vast cutovers and monoculture-like tree plantations behind, even in places where ancient, biologically diverse woodland had thrived shortly before (Oldhammer & Hedmark 2017) (Fig. 4).

The gall midge specimens interpreted here were collected by Malaise traps in 2019 in the central and lower parts of the Unnån valley (Fig. 1). Our six traps were set up in the end of May in old stands of natural forest, predominated by coniferous trees (Norway spruce, *Picea abies* (L.) H. Karst. and Scots pine, *Pinus sylvestris* L.), variously interspersed by small-leaved softwoods, such as birch (*Betula* sp. L), willow (*Salix* sp. L.), alder (*Alnus* sp. Mill.) and aspen (*Populus tremula* L.). The old-growth character of most sites was clearly indicated by plenty of dead wood, both lying and standing, and thick pads of mosses and lichens covering everything from fallen trees to rocks and the forest floor (Figs 5–6). The amount of dead wood usually found in old, natural woodland was in several of our sites even enlarged by enormous accumulations of coarse wood debris, brought and deposited by the immensely forceful spring floods of melt water for which the Unnån and its floodplain forest have gained fame. Both Turander *et al.* (2018) and Oldhammer *et al.* (2019) provide

Figure 3. The Unnån river during the snow melting period (picture taken on 8 May 2013). Photo: B. Oldhammer.
Figur 3. Unnån under snäsmältningsperioden (bilden är tagen den 8:e maj, 2013. Foto: B. Oldhammer.

impressive photographic documents of the valley's dynamics. Altogether, we regard the environment of our sample sites as nearly perfect for mycophagous gall midges. Two of the traps, of which one captured the new species described here, were placed in small clearings surrounded by forest – apparently former meadows, long abandoned and now partly overgrown with woody plants (Figs 7–8). Malaise traps placed in such airstream corridors are likely to catch drifting insects (such as midges) more effectively than traps in the dense forest interior, which are out to collect the adults hatched from nearby larval substrates (such as dead wood in an advanced stage of decay, Fig. 5). All traps were serviced once per month throughout till the end of September by members of Naturskyddsföreningen Dalarna, Bengt Oldhammer and Kjell Hedmark, who supported our activities also by their intimate knowledge of the study area's history, habitat features and biota.

Our 2019 collecting campaign in the Unnån valley was basically a follow-up of a similar effort in 2018, which was balked by a long-lasting, severe drought that affected not only Sweden but much of Europe. Our collecting result in 2018 must be regarded as non-success, apparently because "our" midges did not hatch in any larger numbers, so that the individual abundance remained dramatically below normal. Our collecting yield in 2019, a year with more normal weather conditions, was clearly larger and more diverse, but still poorer than we had anticipated from such promising trap sites. One can speculate whether this was an aftermath of the 2018 drought (a catastrophic event that must have affected the reproduction activity and success of "our" midges) or an impact of cecidomyiid populations being depauperated in consequence of large-scale habitat loss and degradation over the past 20 or so years, or a combined effect of both.

For morphological scrutiny, specimens were prepared as transmitted light-microscopical preparations, i.e. mounted on microscope slides in Canada balsam (Fig. 9), following the procedure described in-detail by Jaschhof & Jaschhof (2009,

Figure 4. Recently logged forest of mature pine and spruce trees on the western bank of Unnån, which is visible as a grey, slightly sloping line in the background, between trap sites 5 and 6 (5 June 2019). Photo: M. Jaschhof.

Figur 4. Nyligen avverkad skog av vuxen tall och gran på västra banken av Unnån, som en grå, något sluttande, linje i bakgrunden, mellan platserna för fälla 5 och 6 (5:e juni, 2019). Foto: M. Jaschhof.

2013). Specimens interpreted here are destined for deposition in the Swedish Museum of Natural History (NHRS). The new species descriptions presented in this paper comply completely with our previous publications on mycophagous cecidomyiids; i.e. morphological terms used here are identical to those applied earlier to the group in question (Jaschhof & Jaschhof 2009, 2013, 2020a, 2020b) and the classification follows that described by Gagné & Jaschhof (2017). Since the two genera involved here were recently revised by us, we feel authorized to present here merely concise species diagnoses, which focus on morphological characters with merit for identification (i.e. generic characters are not reiterated here), supplemented with characters that might gain taxonomic importance when further, new species come in addition (which we regard as likely). As a matter of fact, genitalic illustrations are of crucial importance for defining and identifying mycophagous cecidomyiids. Numbered arrows ($\downarrow^1$, $\downarrow^2$, …) are used to highlight key diagnostic characters in both the wording and illustrations of a description. In illustrations, one of the gonostyli, the ninth tergite, the hypoproct and the cerci are omitted because they do not have taxonomic characters. Abbreviations used here are NR, for nature reserve; MT, for Malaise trap; and spn(s), for specimen(s).

Results

Descriptions of new species

Cassidoides bertanderssoni Jaschhof & Jaschhof **sp. nov.** (Figs 10a–c)

Cassidoides Mamaev, 1960, a genus of the Porricondylinae: Porricondylini, was recently revised by Jaschhof & Jaschhof (2013: 297ff.) and it contains four species, all present in Sweden (Jaschhof & Jaschhof 2013, 2020a). The species

Figure 5. Malaise trap 4, with the junior author in the background (5 June 2019). Photo: B. Oldhammer.

Figur 5. Malaisefälla 4, med andraförfattaren i bakgrunden (5:e juni, 2019). Foto: B. Oldhammer.

named here as *Cassidoides bertanderssoni* was known to us prior to our Unnån survey, but the specimens we had previously available (see below) were not sufficient for taxonomic description. The specimen designated here as the holotype of *C. bertanderssoni* was collected by our Malaise trap 6 (Fig. 8), the same trap that captured the holotype of *Coccopsilis omtanke*, the species described next. *Cassidoides bertanderssoni* has all the features typical of the genus (Jaschhof & Jaschhof 2013: 297), although the number of flagellomeres cannot be assessed since both antennae are broken off.

Diagnosis. Male genitalic structures are diagnostic of *C. bertanderssoni*, as follows. The claw-like structure at the gonostylar apex, a dense comb of short spines, is broad and lacks a depression at the base; as a result, the posterior gonostylar surface is perfectly rounded, not dented (Fig. 10b, ↓[1]). A non-sclerotized structure ventrally of the tegmen, probably the aedeagus, bears apically a sparse tuft of microtrichia of considerable size (Figs 10a–b, ↓[2]). The rod-like portion of the aedeagal apodeme is long and thin (Fig. 10b, ↓[3]), the apex is an oval broadening of unsharp outline. The gonocoxal ventral emargination is large, broadly U-shaped and framed by a bare margin (Fig. 10b, ↓[4]); the pair of processes on both sides of the emargination are fairly long, bent outwards and only basally sclerotized, while the distal portions are largely membranous (Fig. 10b, ↓[5]). Female, larva and pupa of this new species are unknown.

Comparison with congeneric species. Another *Cassidoides* with apically microtrichose aedeagus is *C. cornutus* (Jaschhof & Jaschhof 2020a: Fig. 2), but in that species the base of the gonostylar claw is dented; the tusk-shaped gonocoxal processes are completely sclerotized and bent inwards; and the rod-like portion of the aedeagal apodeme is short and thick.

Other male characters. The only (nearly) complete male at our disposal is a yellowish specimen, whose narrow wings are longer than the body (body length 1.3 mm, wing length 1.6 mm). The eye bridge is very short, only 1–2 ommatidia

Figure 6. Bengt Oldhammer (left) and Kjell Hedmark (right) discussing the next steps of the field work near trap site 4 (5 June 2019). Photo: M. Jaschhof.

Figur 6. Bengt Oldhammer (vänster) och Kjell Hedmark (höger) diskuterar fältarbetets nästa steg nära platsen för fälla 4 (5:e juni, 2019). Foto: M. Jaschhof.

long dorsally. The necks of the flagellomeres are markedly longer than the nodes (Fig. 10c). The pronotum has 1–2 setae, the anepisternum is asetose, and the anepimeron has 2 setae. Vein M_4 (labeled as CuA_1 in our 2013 paper) is absent, while CuA ends well before the wing edge. Of the foreleg, the femur is 1.1 times as long as the tibia, and the tibia is 0.9 times as long as the second tarsomere.

Etymology. This species is named in silent memory of the woodsman and conservationist Bert Andersson (1949–2016), grown up in the then roadless forest land of northwestern Hälsingland. Bert's tremendous knowledge of the forest world of western central Sweden was surpassed solely by his love to those forests' magic and biological riches.

Type material. Holotype. ♂ **SWEDEN: Dalarna**, Orsa, Unnån valley, western bank of Unnån, 1.5 km SE Hornberga, Storängsheden, 61°11'06"N / 14°38'39"E, clearing surrounded by mature boreal forest of predominantly spruce and pine trees, 4 Jul.–1 Aug. 2019, MT, M. Jaschhof, C. Jaschhof, B. Oldhammer & K. Hedmark leg. (spn CEC3390 in NHRS).

Remark on the type locality. It is likely that *C. bertanderssoni* is an inhabitant of the forest interior rather than the clearing where it was actually captured. The clearing had probably just a channelling effect for insect aeroplankton coming mostly from nearby forest.

Other specimens studied. **SWEDEN: Småland**, Nybro, Bäckebo, Grytsjön NR, old-growth hemiboreal forest of predominantly pine, spruce and aspen trees, 1 male (only genitalia on slide), 18 Jun. 2014, sweepnet and exhaustor, M. Jaschhof & C. Jaschhof leg. (spn GBOL2537369 in NHRS); **Öland**, Borgholm, S Trollskogen NR, mature pine forest interspersed with birch and spruce trees, 2 males (only genitalia on slide), 5 Jul. 2014, sweepnet, M. Jaschhof & C. Jaschhof leg. (spns GBOL2537359–GBOL2537360 in NHRS).

Figure 7. Malaise trap 2, which captured the only known specimens from Sweden of *Neurolyga interrupta* Jaschhof, 2009. On 5 June 2019, the day the picture was taken, the forest slightly south of the trap site was found marked for logging. Persons shown in this scene are, from left to right, Bengt Oldhammer, Kjell Hedmark and the junior author. Photo: M. Jaschhof.

Figur 7. Malaisefälla 2, som fångade den enda kända individen från Sverige av *Neurolyga interrupta* Jaschhof, 2009. Den 5:e juni, 2019, när bilden togs, markerades skogen något söder om fällan för avverkning. Personer som syns i bilden är, från vänster till höger, Bengt Oldhammer, Kjell Hedmark, och andraförfattaren. Foto: M. Jaschhof.

Coccopsilis omtanke Jaschhof & Jaschhof **sp. nov.** (Figs 10d–e)

Coccopsilis Harris, 2004, a further genus belonging to the Porricondylini, is remarkable for that the morphology of males is partly regressive, just as in *Cassidoides*. The genus contained previously nine Palearctic species, of which six were shown to occur in Sweden (Jaschhof & Jaschhof 2013: 302ff.; 2020a: 154ff.). A tenth species, described and named here *C. omtanke*, is peculiar for the tegmen, whose apex is bent dorsad. Previously, we regarded the straight, posteriad directed tegmen as an important generic character of *Coccopsilis* and thus as a distinction to *Cassidoides*. Research in the future, which is likely to unearth further species, will show whether it is appropriate to maintain the separation of both genera, which so far are based largely on male genitalic indicators.

Diagnosis. *Coccopsilis omtanke* is unique in the tegmen having a pointed and recurved apex so that it forms a hook; in ventro-dorsal view, which is exhibited in the holotype, this hook appears merely as a reverse drop-shaped structure (Fig. 10d, ↓[6]). As another peculiarity, the aedeagal apodeme is shaped like a tennis racket, with both the rod-like and oval portions being equally strongly sclerotized (Fig. 10d, ↓[7]). These two characters render the new species absolutely unmistakable. Females, larvae and pupae of *C. omtanke* are unknown.

Other male characters. The single male at our disposal is a completely yellowish specimen, with the antennae slightly shorter and the wings slightly longer than the body (length 2.3 mm). The eye bridge is 3–4 ommatidia long dorsally. The number

Figure 8. Trap site 6, the type locality of both *Cassidoides bertanderssoni* **sp. nov.** and *Coccopsilis omtanke* **sp. nov.** This site is an abandoned meadow, now partly overgrown with young alder (*Alnus* sp. Mill.) trees. The surrounding woodland is of the same kind as the recently logged forest found slightly north from here (cf. Fig. 4). Photo: M. Jaschhof.

Figur 8. Platsen för fälla 6, typlokalen för både *Cassidoides bertanderssoni* **sp. nov.** och *Coccopsilis omtanke* **sp. nov.** Platsen är en övergiven äng, ny delvis övervuxen med al (*Alnus* sp. Mill.). Omgivande skogslandskap är av samma typ som nyligen avverkades något norr från denna plats (jmf. Fig. 4). Foto: M. Jaschhof.

of flagellomeres is 13; the flagellomeral necks are much longer than the nodes (Fig. 10e). There are 2 pronotal, 3 anepisternal and 6 anepimeral setae. CuA ends well before the wing edge. The femur of the foreleg is 1.1 times as long as the tibia; the relative length of the second tarsomere cannot be assessed since both forelegs are broken off behind the first tarsomeres. The claws have 1 large and 2 much smaller teeth basally. The gonostylus is both slightly flattened and bent; the pectinate claw at its apex, which is both long and broad, is slightly dented at the base (Fig. 10d). The gonocoxal synsclerite is almost completely setose, except for a broad, asetose margin below the ventral emargination; the gonocoxal processes are long, reaching to almost the apex of the tegmen, which they sheath from both sides (Fig. 10d).

Etymology. The Nordic word *omtanke*, merely imperfectly translated as consideration or concern, describes the attitude that everything one does is done out of the heartfelt desire and responsibility to make the counterside feel comfortable. This counterside does not necessarily need to be a fellow human being; *omtanke* can also be thought as being directed towards something non-human, be it an insect, a woodland, a river ecosystem, or the Earth. See the discussion at the end of this paper. The species epithet is used as a postpositive noun.

Type material. Holotype. ♂ **SWEDEN: Dalarna**, Orsa, Unnån valley, western bank of Unnån, 1.5 km SE Hornberga, Storängsheden, 61°11’06”N / 14°38’39”E, clearing surrounded by mature boreal forest of predominantly spruce and pine trees, 4 Jul.–1 Aug. 2019, MT, M. Jaschhof, C. Jaschhof, B. Oldhammer & K. Hedmark leg. (spn CEC3389 in NHRS).

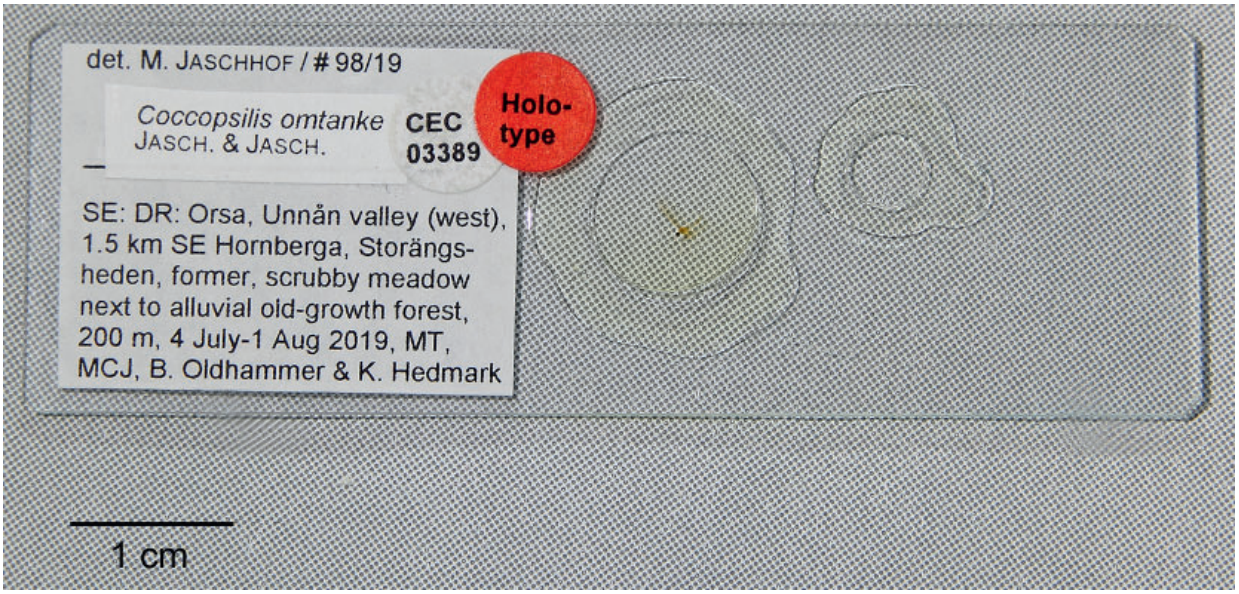

Figure 9. Slide-mounted specimen (holotype of *Coccopsilis omtanke* **sp. nov.**) prepared for study by transmitted-light microscope. The genitalia, which provide characters of merit for the identification of species, are mounted separately (small cover slip) from the rest of the body (large cover slip). Photo: M. Jaschhof.

Figur 9. Individ (holoypen av *Coccopsilis omtanke* **sp. nov.**) monterad på objektsglas och preparerad för studier i ljusmikroskop. Genitaliera, som består av de viktigaste karaktärerna för artbestämning, monteras separat (lilla täckglaset) från resten av kroppen (stora täckglaset). Foto: M. Jaschhof.

Species new to the Swedish fauna

Camptomyia regia Spungis, 1989

Camptomyia Loew, 1850 is a Holarctic-Neotropical genus of 71 species, of which 30 occur in Europe and 24 are known from Sweden (Gagné & Jaschhof 2017; Jaschhof & Jaschhof 2013, 2019). Our two specimens obtained from the Unnån valley are the first findings of *C. regia* outside the type locality in Latvia, where the describing author had in his day collected only a single male (Spungis 1989). Upon our reexamination, the Swedish specimens of *C. regia* referred to by Jaschhof & Jaschhof (2013) turned out as belonging to an unnamed *Camptomyia* species, of which the formal description is forthcoming (Jaschhof & Jaschhof, in prep.). The Finnish records of *C. regia*, which led to this species' inclusion in the checklist by Jaschhof et al. (2014), also rest on confusion with the abovementioned, unnamed species.

Specimens studied. **SWEDEN: Dalarna**, Orsa, Unnån valley, 8 km SE Näckådalen, Långfloten, 61°17'12"N / 14°32'24"E, mature boreal forest of spruce, birch and pine, 1♂, 4 Jul.–1 Aug. 2019, Malaise trap, M. Jaschhof, C. Jaschhof, B. Oldhammer & K. Hedmark (spn CEC3387 in NHRS); Unnån valley, 1.5 km SE Hornberga, Storängsheden, 61°11'06"N / 14°38'39"E, clearing surrounded by mature boreal forest of predominantly spruce and pine trees, 1♂, 4 Jul.–1 Aug. 2019, Malaise trap, M. & C. Jaschhof, B. Oldhammer & K. Hedmark (spn CEC3393 in SDEI).

Neurolyga interrupta Jaschhof, 2009

Neurolyga Rondani, 1840 is a Holarctic genus of 27 species, of which 22 occur in Europe and 18 were previously known from Sweden (Jaschhof & Jaschhof 2009: 123ff; 2020b: 360ff.). The species newly recorded here, *N. interrupta*, was originally described from the Russian Federation/ Republic of Karelia, Finland and Norway (Jaschhof & Jaschhof 2009) and subsequently found to occur in the Czech Republic (Sikora et al. 2017). Therefore, its occurrence in Sweden could be expected. Anyhow, all material previously known of this species consists of only eight specimens, i.e. *N. interrupta* is certainly one of the rarely collected mycophages. Our two specimens from the Unnån valley were captured by Malaise trap 2 (Fig. 7).

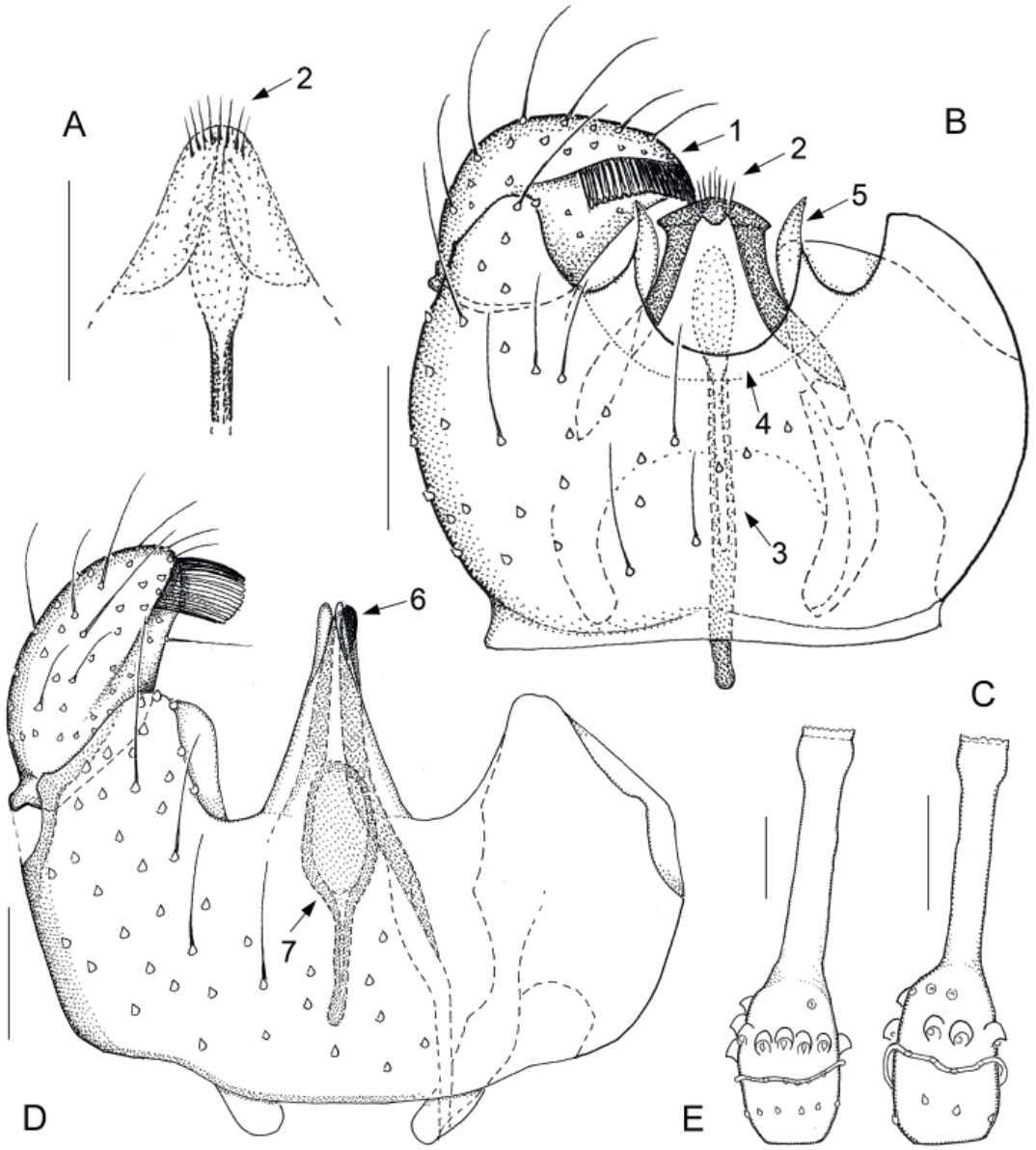

Figure 10. Male morphology of *Cassidoides bertanderssoni* **sp. nov.** (A–C) and *Coccopsilis omtanke* **sp. nov.** – (D–E), holotypes. Scale: 0.05 mm. Numbered arrows refer to diagnostic characters described in the text. – A) Aedeagus and apex of aedeagal apodeme, ventral; – B) genitalia, ventral; – C) fourth flagellomere, lateral; – D) genitalia, ventral; – E) fourth flagellomere, lateral.

Figur 10. Morfologiska karaktärer hos hanar av *Cassidoides bertanderssoni* **sp. nov.** (A–C) och *Coccopsilis omtanke* **sp. nov.** – (D–E), holotyper. Skalstreck: 0,05 mm. Numrerade pilar refererar till diagnostiska karaktärer i texten. – A) Aedeagus och apex av aedeagal apodem, underifrån; – B) genitalier, underifrån; – C) fjärde antennsegmentet, från sidan; – D) genitalier, underifrån; – E) fjärde antennsegmentet, från sidan.

Specimens studied. **SWEDEN: Dalarna**, Orsa, Unnån valley, eastern bank of Unnån, 8 km SE Näckådalen, Djupnäs, 61°11'06"N / 14°38'39"E, small clearing in mature boreal forest of predominantly spruce, birch and pine trees, 1♂, 28 May–3 Jul. 2019, MT, M. Jaschhof, C. Jaschhof, B. Oldhammer & K. Hedmark leg. (spn CEC3391 in NHRS); same locality, 1 male, 4 Jul.–1 Aug. 2019 (spn CEC3392 in NHRS).

Discussion

Thanks to research funded by The Swedish Taxonomy Initiative since 2003, we are now informed about the presence of 800 mycophagous gall midge species in Sweden (e.g. Jaschhof & Jaschhof 2009, 2013, 2019, 2020a, 2020b, in prep.). This, coupled with our (and other experts') observation that the individual abundance of mycophagous cecidomyiids in nature is really substantial, leads us to conclude that the dipterans in question play a significant role in terrestrial ecosystems, particularly in decomposition processes in woodlands. In the absence of research into the biological relevance of "our" midges, we have to content ourselves, for the time being, with this level of knowledge. At the same time, enough observations have accumulated (again, by us and other specialists in the field) to assume that there are many species, perhaps 50% of Sweden's species total, that are ecological specialists rather than generalists, i.e. strictly depending on a narrow array of ecological factors. Although the specific factors limiting a species' occurrence are usually unknown due to lack of research, it is likely that the fungal host is rather important, if not crucial. In parallel to mycophagous cecidomyiids, a considerable number of fungi are ecologically specialized, which is why they are used as indicator species of certain natural habitats, including those being unusually susceptible to disturbance by human activities, and therefore scarce and deserving legal protection. It is for long known that some fungi signal, unfailingly, woodland continuity, i.e. persistence in the presence of living trees, dead wood and undisturbed soil (Nitare 2019). It stands to reason, therefore, that certain mycophagous cecidomyiids, in particular those living in association with fungal indicator species, could be used as an assessment tool to the same effect – given that we would be better informed about the factors defining their ecological niches. Although such information is not available for the new gall midges described here, we feel qualified to assume that their discovery precisely in Unnån's floodplain forest reveals something about the quality of the habitat. We need to call to mind here that our taxonomic inventory in Sweden runs meanwhile for 15 years, with much effort expended on mapping the species found in the central parts of the country, Dalarna included. It is obvious that any species discovered only now, at this late stage of our survey, is no common but likely either a restricted-range or a limited-resource species. This assumption is borne out by the fact that both species are known from a very few specimens only, in spite of considerable collecting effort at the localities where they were eventually found. The limited resource hypothesis seems more plausible to us, since we know from experience that species of mycophagous cecidomyiids usually occupy fairly large areas (which, *en passant*, is another parallel to fungi). Corresponding to this, *Cassidoides bertanderssoni* was found to occur, besides Dalarna, in both Småland and Öland, in each case in mature coniferous forest. The discovery of two previously unnamed species under the circumstances described above, plus two species whose presence in Sweden was recorded here for the first time, may in our opinion be rated as a further indication of that the Unnån valley as described by Turander *et al.* (2018) is absolutely worth of legal protection. Worth recalling here, in 2018 we described a further new species of mycophagous gall midge from the Unnån valley: *Camptomyia oldhammeri* Jaschhof & Jaschhof, 2019; a porricondyline now known from two specimens found in locality 1 (Fig. 1), and from a single specimen discovered recently in Slovak Republic's Muranska Planina National Park, more precisely in a nature reserve protecting old-growth forest of spruce interspersed with rowan and beech trees (Tomáš Sikora, pers. com.). We even know of a fourth new species from Unnån's floodplain forest, a member of the Micromyinae: Micromyini, which will be published in the context of a comprehensive revision of the extremely complex and problematic tribe to which it belongs.

We are aware of the fact that, in practice, the process of assessing an area's protection value is based on nothing else but hard facts. Even if we would go as far and label our new species as data-deficient but potentially conservation-dependent,

this would not be considered as a facts-based argument *pro* conservation. Also, it is obvious that type locality status has outside of academia no relevance. However, in the case of Unnån valley it turned out that even the hard facts, such as concrete and abundant records of red-listed species, have limited persuasive power. Although Turander's *et al.* (2018) report was appreciated by the local nature protection agency as providing plenty of evidence of that the Unnån valley should be made a nature reserve, no such process has so far been initiated, with reference to lack of financial means for purchasing the forest from a myriad of landowners (B. Oldhammer and K. Hedmark, pers. com.). In our opinion this reduces the matter to a purely economic issue, which does not do justice to the matter. The fact is that the impact of present-day forestry practices on Dalarna's forest landscape, including the Unnån valley, is so fundamental, and thus so blatantly obvious, that any attempt to trivialize strongly negative consequences for the region's woodland biota must be considered as either naive or willful. To translate this impact into the world humans are better familiar with: A 40 years old pine plantation would be referred to by most people as a forest, while for most mycophagous cecidomyiids such an assemblage of trees is uninhabitable land – in a similar manner as is a house whose window panes are broken, water pipes are blocked up and electric cables are cut. Likewise, a clear-felled area withholds mycophagous cecidomyiids from both shelter and comfort, in the same way as a house burned down to the foundations is uninhabitable for humans.

Some might be of a different opinion, arguing that an area containing plenty of red-listed and otherwise rare species cannot be regarded as looted. There is some truth in this argument: the Unnån valley is still a treasure box for naturalists. But this is no reason for unconcern. The clear-felling of the Unnån valley continues following a piece-by-piece strategy (pers. obs.; B. Oldhammer and K. Hedmark, pers. com.; Fig. 4), apparently in the hope that the principle of shifting baselines would once more do the job: take a bit at a time and in the long term scarcely anybody will notice the plundering on a grand scale. Also, the biological richness found today in Unnån's valley must be imagined as a vestige of former glory, which, again, is something we cannot prove beyond doubt for lack of long-term data regarding "our" midges. Nonetheless, when acknowledging the relevance of hard facts, one must be so fair to admit that science is unable to define the point of no return for a complex ecosystem like Unnån's, meaning we lack the knowledge to predict the moment when the system will "keel over" due to loss of stability. And then, even if we would have that knowledge available, is it opportune to weaken the system up to the point right before that very last moment?

We have the impression that the Unnån issue is of nationwide relevance rather than being a merely regionally important matter. Also, the problems raised here have some bearing on the societal role of science, here taxonomy. If Bickel (2009) is right with his statement that the conservation argument ("We need to know what we want to conserve, and to know species and their phylogeny will help us make conservation decisions.") is of problematic merit with megadiverse groups of flies because we already know enough based on vertebrates, vascular plants and biotic communities to make these choices, then the question appears how taxonomic surveys of small, uncharismatic arthropods, such as "our" midges, can be justified to tax payers who finance them. On top of that, the conservation argument is nowadays also put forward to motivate the need of accelerating the species discovery and description process by new technology and methodology. This is not to say that we believe that mycophagous gall midges will ever tip the balance in favor of establishing a nature reserve, but no doubt they represent a significant component of the biotic community that lends a local ecosystem its singularity and keeps it functioning. Therefore we, as scientists and taxonomic authors – and fellow citizens, to be sure – feel obliged to make a point of contributing to resolve the Unnån issue.

It seems that the Unnån conflict has a chance to get resolved when all individual and institutional players involved bethink of *omtanke*, a moral concept that outside of Scandinavia is regarded – and often adored – as genuinly Nordic (note that both the present authors were born and socialized in East Germany, even though living in Sweden since 2015). The naming of *Coccopsilis omtanke*, to present knowledge an Unnån valley endemic, is meant to be an icon, standing for our firm belief that the conflict in question can be resolved – on

condition that Unnån's ecosystem is conceived as something of intrinsic, not first of all monetary value; something of fundamental interest to the whole society rather than a matter of private ownership and beneficiary interest. This here is not the place to detail the conflict at length; for those who wish to investigate more deeply we suggest reading the publications by the Nature Conservation Society of Dalarna (Oldhammer & Hedmark 2017) and Turander *et al.* (2018). In the end, the Unnån conflict appears as a local version of human-caused, global crises, such as the climate change and biodiversity loss. To resolve this conflict to the benefit of Unnån's ecosystem would match the triumph of *Homo sapiens* (*sapiens* = Latin for rational) over *Homo economicus*.

Is there something else that a few new species descriptions can contribute to find an *omtanke* solution for the Unnån valley? In our opinion, a new species is peculiar enough to become a part of the local history – identity-establishing in the same way as the "flower (bird, animal, butterfly, mineral, etc.) of the region" idea. The type locality of an insect species should be conveyed to the local public as a remarkable, unique place, as an icon for the singularity and vulnerability of the local nature. In this sense, type localities are comprehensible as facets of the *skogsriken* (forest's empire or forestdom) concept (Oldhammer & Hedmark 2017). As is common knowledge, humans, children in particular, have a fascination for everything possessing unique characteristics, just as they love to be actively engaged in exploring the microcosm of their homeland. This is a chance for citizen science in a broad sense. In our mind's eye, we foresee school kids joining biology teachers, naturalists and scientists in discovering and mapping somehow peculiar organisms, including new species, in "their" forest plots. The Unnån valley is large enough to provide several groups of school kids with space for research expeditions, preferably done in a friendly-competitive way ("Whose plot contains the highest number of (red-listed) species? Who will be the first in discovering a species unknown to science?"). No youngster wants his study grounds see destroyed, making it likely that an even closer, emotional bond with nature develops. Also, there is the naming part of a taxonomic description, which is – as we ourselves had occasion to witness – extremely exciting to humans of very age. A youngster given the opportunity to propose a new species' name will never forget this, and is forced to deal with multiple issues, including who, or what is appreciated as inspiring and shining enough to be conserved for eternity as a taxonomic name. This kind of unobtrusive teaching should be combined with imparting knowledge of how humans should use nature reasonably as a resource, for instance for timber harvest. Youngsters having serviced a Malaise trap for a couple of months, or even years – schools could run long-lasting monitoring projects in collaboration with scientists – will know from own experience that a part of the forest needs to remain untouched by man as to provide a habitat for organisms other than humans. Needless to say, the brainstorming is certainly more easily done than the implementing part of any project aiming to educate the young generation in sustainable behaviors. Anyhow, taxonomy has the power to help forming this process.

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Sammanfattning

Två arter mykofaga gallmyggor (Cecidomyiidae: Porricondylinae: Porricondylini) beskrivs som nya för vetenskapen och benämnes *Cassidoides bertanderssoni* **sp. nov.** och *Coccopsilis omtanke* **sp. nov.** Båda arterna upptäcktes 2019 under en taxonomisk inventering av mykofaga gallmyggor i Unnåns dalgång norr om Orsa i Dalarna, vilken utförligt dokumenterats och visat sig vara ett område med extraordinär biologisk mångfald. Andra exemplar som samlats in under denna undersökning representerar de första svenska uppgifterna om de mykofaga cecidomyiiderna Camptomyia regia Spungis, 1989 och Neurolyga interrupta Jaschhof, 2009. Den oreglerade, snabbt flytande Unnån är särskilt anmärkningsvärd för den djungelliknande skogen på svämplanet. Omfattande och till stor del orörda sträckor har överlevt fram till i dag och visar sig vara livsmiljö för tidigare okända insektsarter. Unnåns ekosystem hotas akut av pågående kalhyggesbruk. Enligt författarnas åsikt är en sådan degradering av levnadsmiljön för oräkneliga organismer, varav många rödlistade, otidsenlig och oacceptabel. Det diskuteras här att nya artbeskrivningar bör inkluderas till andra försök att öka medvetenheten om naturliga livsmiljöers inneboende värde, inklusive gammelskogens, särskilt i lokal eller regional skala. Unnån fungerar här som ett exempel. Begreppet omtanke framhävs som en verkligt svensk eller skandinavisk princip, som här anses ha förmågan att försona och medverka till att lösa Unnån-konflikten under förutsättning att den genomförs resolut och relevant.