Report of a new non-native insect (moth fly) on King George Island, South Shetland Islands

**Report of a new non-native insect (moth fly) on King George Island, South Shetland Islands**

**Information Paper submitted by Chile and the Republic of Korea**

***Summary***

A new non-native insect, the moth fly, *Psychoda albipennis* (Diptera: Psychodidae), was found inside the sewage treatment buildings at two research bases (Frei Base and King Sejong Station) on King George Island in 2019/2020 and 2021/22 season, respectively. To avoid further spread of the moth fly, it is urgently required that all Parties operating their Antarctic programmes on the island should check their facilities whether they are infested with the non-native fly, *P. albipennis.* Each Party is strongly encouraged to conduct monitoring of the moth fly in its facility and remove the new non-native species if found, before it further disperses within the island like the case of the non-native winter crane fly (*Trichocera maculipennis*).

***Background***

In the context of recent global climate change, Antarctic ecosystems are faced with continuous threats of the invasion of non-native species as well as unwanted impacts of the species that have already become invasive (Frenot et al. 2005; Chown et al. 2012; Hughes et al. 2019, 2020; Chwedorzewska et al. 2020; Bertlett et al 2021). Currently, the drivers of biological invasion have been related to increasing human activities such as scientific programmes and tourism in Antarctica (McGeoch et al. 2015). In this context, there are some detailed investigations indicating that the pathways of unintentional introduction of alien invertebrates is related to the national Antarctic programmes (Chwedorzewska et al. 2013; Houghton et al. 2016). The substantial number of inadvertent introductions are insects, many of which have established successfully in their invasive habitats, giving subsequent impacts on the Antarctic biota (Chown and Convey 2016). Approximately 200 species, comprising one-third of known non-native species established in Antarctica and sub-Antarctic islands, are insects (Frenot et al. 2005; Chown and Convey 2016). Currently, a winged winter crane fly, *Trichocera maculipennis* (Diptera: Trichoceridae) has established in synanthropic habitats, and most likely in natural environments in King George Island as well. The winter crane fly, known as a holarctic species, has a very broad native range that is comprised of Europe, North America, and Asia including India, covering from temperate to Arctic regions (Dahl 1970; Petrašiūnas and Podenas 2017; Potocka and Krzmińska 2018).

Since 2007, there have been reports of infestations of the non-native winter crane fly, *T. maculipennis*, in and around the sewage treatment facilities of at least six Antarctic stations in Maxwell Bay and one in Admiralty Bay. Some infested stations (Uruguay, Republic of Korea, and Poland) have attempted separately to eradicate the winter crane fly from their facilities (Volonterio et al. 2013; León et al. 2021; ATCM XLIII–IP88). To achieve more effective monitoring and control of the non-native winter crane fly, most of the parties to the Antarctic Treaty operating research bases in the island have been participating in a joint programme, collaborating on efforts to find out suitable management measures of this species (ATCM XLI – IP 50; ATCM XLII – IP120; ATCM XLIII –IP35, IP88). Nevertheless, effective control measure and eradication tactics that can be applied across different stations have yet to be developed against the non-native fly, although the efforts to stop their dispersal and inter-station movements have been made over the last years. Meanwhile, we found a new non-native insect at two research bases in the island and would like to inform CEP members our observations to prevent its further expansion.

***Non-native insect detection and identification***

During a routine inspection of UV traps in December 2019 as a joint effort to monitor the non-native winter crane fly, the presence of several small live insects was discovered inside a sewage treatment building at the Chilean Frei Base in King George Island. The insects were then tentatively identified as a moth fly (Figure 1). The presence of the moth fly in the building was further confirmed in two more visits during December 2019-January 2020. We identified the moth fly through DNA barcoding (i.e. cytochrome c oxidase subunit I (COI) gene sequences of mitochondrial DNA) at Korea Polar Research Institute in 2021, confirming that the moth fly is *Psychoda albipennis* (Diptera: Psyschodidae) with 100% similarity to its northern American population and that of Kerguelen Islands on the Barcode of Life Data (BOLD) system (https://www.boldsystems.org/). The moth fly, *P. albipennis*, is known as a cosmopolitan species, and adult flies are often seen in various places with high moisture, including bathrooms and toilets. Moth fly larvae usually occur in aquatic habitats. Although moth flies do not bite, their larvae can be a serious health problem, causing human urinary myiasis (Shimpi et al. 2018). During the 2021/2022 season, a small number of the moth fly adults was additionally found at the sewage treatment facility in King Sejong Station.

***Response and monitoring***

The moth fly adults discovered in King Sejong Station were fewer than ten in total, when observed over a period of a month between December 2021 and February 2022. Monitoring and removal of the moth fly adults are currently being conducted by routine visual inspection and with UV traps which have been used for the monitoring of the winter crane fly, *T. maculipennis*. We now have a plan to investigate whether whole life cycle of the moth fly is successfully completed in the facilities of two research bases during 2022/23 season. A female moth fly disposing eggs was collected in Frei base in 2019/20 season although it was unclear if the moth flies could lay viable eggs in these facilities (see Figure 1B).

***Conclusions***

Currently, the non-native moth flies have been found only in synanthropic habitats in King George Island. Although their reproduction and other biology in the stations’ facilities is yet unknown, their successful reproduction in the station appears highly likely, considering their occurrence, biology and habitat preference. The larvae of moth flies (genus *Psychoda*) have been found together with those of *T. maculipennis* in synanthropic habitats (Karandikar 1931). To avoid further spread of the moth fly in King George Island, it is urgently required that all Parties operating their Antarctic programmes on the island check if their facilities are infested with any moth flies*.* Otherwise, the moth fly may be introduced unintentionally into other research bases and establish its populations there as *T. maculipennis* did. Unlike the winter crane fly, moth flies can have multiple generations a year since they can complete a life cycle in a short period of time, which is a serious concern in their invasive habitat as a large population can easily build up. Therefore, we encouragethe Parties to undertake periodic monitoring outside and inside of their facilities and supply chains, at the moment sending cargo to Antarctica and while it is moved into other places, and to consider co-ordinated responses against the new non-native moth fly as well as the other non-native fly, winter crane fly (*T. maculipennis*).

Imagen que contiene gato, foto, pájaro, viendo

Descripción generada automáticamente

*Figure 1 – Moth flies discovered at Frei Base in King George Island. A: Moth flies harvested from a UV trap; B: A female moth fly disposing eggs; C: A wing showing simple wing venation typical to moth flies.*

Bibliography

Bartlett J.C., Convey P.C., Hughes K.A., Thorpe S.E. & Hayward S.A.L. (2021) Ocean currents as a potential pathway for Antarctica’s most persistent non-native terrestrial insect. Polar Biol. 44: 209-216.

Chwedorzewska K.J., Korczak-Abshire M., Olech M., Lityńska-Zając M. & Augustyniuk-Kram A. (2013) Alien invertebrates transported accidentally to the Polish Antarctic Station in cargo and on fresh foods. Pol. Polar Res. 34: 55-66.

Chwedorzewska K.J., Korczak-Abshire M., & Znój A. (2020) Is Antarctica under threat of alien species invasion? Glob. Change Biol. (2020) 26: 1942-1943.

Chown S.L. & Convey P. (2016) Antarctic entomology. Annu. Rev. Entomol. 61: 119–137.

Chown S.L., Lee J.E., Hughes K.A., Barnes J., Barrett P.J., Bergstrom D.M., Convey P., Cowan D.A., Crosbie K., Dyer G., Frenot Y., Grant S.M., Herr D., Kennicutt M.C., Lamers M., Murray A., Possingham H.P., Reid K., Riddle M.J., Ryan P.G., Sanson M., Shaw J.D., Sparrow M.D., Summerhayes C., Terauds A., & Wall D.H. (2012) Challenges to the future conservation of the Antarctic. Science 337: 158–159.

Dahl C. (1970) Distribution, phenology and adaptation to Arctic environment in Trichoceridae (Diptera). Oikos 21: 185-202.

Frenot Y., Chown S.L., Whinam J., Selkirk P., Convey P., Skotnicki M., & Bergstrom D. (2005) Biological invasions in the Antarctic: extent, impacts and implications. Biol. Rev. 80: 45–72.

Houghton M., McQuillan P.B., Bergstrom D.M., Frost L., Van Den Hoff J., & Shaw J. (2016) Pathways of alien invertebrate transfer to the Antarctic region. Polar Biol. 39: 23–33.

Hughes K.A., Convey P., Pertierra L.R., Vega G.C., Aragón P., Olalla-Tárraga M.Á. (2019) Human-mediated dispersal of terrestrial species between Antarctic biogeographic regions: a preliminary risk assessment. J Environ Manag. 232: 73–89.

Hughes K.A., Pescott O.L., Peyton J., Adriaens T., Cottier-Cook E.J., Key G., Rabitsch W., Tricarico E., Barnes D.K.A., Baxter N., Belchier M., Blake D., Convey P., Dawson W., Frohlich D., Gardiner L.M., González-Moreno P., James R., Malumphy C., Martin S., Martinou A..F, Minchin D., Monaco A., Moore N., Morley S.A., Ross K., Shanklin J., Turvey K., Vaughan D., Vaux A.G.C., Werenkraut V., Winfield I.J. & Roy H.E. (2020) Invasive non‐native species likely to threaten biodiversity and ecosystems in the Antarctic Peninsula region. Glob Change Biol 26:2702–2716. <https://doi.org/10.1111/gcb.14938>

Karandikar K.R. (1931) The early stages and bionomics of *Trichocera maculipennis* (Meig.) (Diptera, Tipulidae). Trans. Ent. Soc. Lond. 79: 249–260.

León M.R.-D., Hughes K.A. & Convey P. (2021) International response under the Antarctic Treaty System to the establishment of non-native fly in Antarctica. Environ. Manag. <https://doi.org/10.1007/s00267-021-01464-z>

McGeoch M.A., Shaw J.D., Terauds A., Lee J.E. & Chown S.L. (2015) Monitoring biological invasion across the broader Antarctic: A based and indicator framework. Glob. Environ. Change 32: 108-125.

Petrašiūnas A. & Podenas S. (2017) New data on winter crane flies (Diptera: Trichoceridae) of Korea with description of a new species. Zootaxa 4311: 561-575.

Potocka M. & Krzemińska E. (2018) *Trichocera maculipennis* (Diptera)—an invasive species in maritime Antarctica. PeerJ 6: e5408. https://doi.org/10.7717/peerj.5408..

Shimpi R., Patel D., Raval K. (2018) Human urinary myiasis by *Psychoda albipennis*: A case report and review of literature. Urology Case Repoets. 21: 122-123.

Volonterio O., de León R.P., Convey P. & Krzeminska E. (2013) First record of Trichoceridae (Diptera) in the maritime Antarctic. Polar Biol. 36: 1125-1131.