A preliminary note to the bionomy of *Colletes inexpectatus* Noskiewicz, 1936 based on observation of a larger nesting site (Hymenoptera: Apiformes)

Martin Riha, Antonin Pridal
Department of Zoology, Fisheries, Hydrobiology and Apidology
Mendel University in Brno
Zemedelska 1, 613 00 Brno
CZECH REPUBLIC

xriha1@node.mendelu.cz

Abstract: The new larger nest site of *Colletes inexpectatus* was discovered for the first in the Czech Republic. Obtained numerous material of this species was used for study of the species bionomy. It resulted that *C. inexpectatus* is not oligolectic on Fabaceae and its nest parasite is *Epeolus variegatus*. We proposed reclassification of the threat of *C. inexpectatus* in the Czech Republic and recommend the natural protection of the habitat.

Key Words: Colletes inexpectatus, faunistics, bionomy, parasite, *Epeolus variegatus*, foraging plant

INTRODUCTION

Colletes inexpectatus was described by Noskiewicz (1936). He noticed that this bee was captured on *Trifolium* and *Medicago* without remark to the parasite. Warncke (1978) regarded *C. inexpectatus* as conspecific with *C. daviesanus* Smith, 1846. This concept was not later followed with emphasizing on distinguishing characters in males (Přidal 1999, Kuhlmann 2000). The general distribution of the species is on the west from Central and Eastern Europe (Austria, Poland, Czech Republic), over the Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) up to the Far East (Mongolia). The records of this species are rather sparsely distributed and usually local with low density in whole region (Lukáš and Okáli 1998, Přidal 2001, Kuhlmann and Dorn 2002, Banaszak 2003, Ebmer 2003, Szczepko et al. 2002, Kuhlmann and Proshchalykin 2011, 2014, Proshchalykin and Kuhlmann 2012), e.g. in the Czech Republic are known only old records before 1966 (Přidal 1999). Therefore, the knowledge about the bionomy of this species are somewhat poor. Ebmer (2003) catched in Austria a female on *Trifolium* sp. This observation would confirmed Noskiewicz's (1936) observation and an assumption about broad oligolecty for Fabaceae in *C. inexpectatus*. However, the study by Mueller and Kuhlmann (2008) palynologically confirmed the presence of pollen grains only from Asteroideae with conclusion "broadly oligolectic on Asteroideae".

A larger nest site of *C. inexpectatus* was discovered in the Czech Republic for the first time, therefore, the object of this contribution is to identify: a) pollen grains on scopa and b) parasites flying in the nest site.

MATERIAL AND METHODS

Locality

The larger nest site, as a loess wall approx. up to 6 m high and 50 m long, was discovered at periphery of the town Oslavany (Moravia, Czech Republic). There was found area about 5 m^2 very densely occupied by *C. inexpectatus* in the year 2017 (hundreds of nests). The last observation of the nest site was realised in 2019 (24th July and 1st August) when the female hatching just started.

Sampling of bees

Bees (both host and parasite) were captured predominantly in close proximity of the nest entrances *C. inexpectatus*. Especially for pollen analysis, the just returning females entering in the nest

entrance were catched by the entomological net. Each captured female was inserted separately into the Eppendorf tube to prevent contamination by pollen from other females.

Preparation

Bees were standardly prepared on entomological pin and dried. Male genitalia were prepared with glue on the card sheet or only as a pulled out from abdomen. Pollen grains from scopa were brushed with needle and tweezers, washed in ether to remove pollenkitt and overlaid by glycerine gelatine on a slide. The gelatine was pure or with dye (fuchsine). The pollen was studied from 17 females sampled on 1st August 2019.

Identification

The bees were identified according to characters by Noskiewicz (1936), Přidal (1999), Kuhlmann and Proshchalykin (2014) and Bogusch and Hadrava (2018). The pollen grains were identified according to the pollen collection in the lab of apidology at Mendel University in Brno.

Examined material

Colletes inexpectatus Noskiewicz, 1936. Moravia, Oslavany, 8.–13.vii.2010, 2 males, 2.viii.2017, 13 males, 120 females, M. Říha coll., 1 male, 1 female, A. Přidal coll., M. Říha lgt. et det., 24.vii.2019, 69 males, 39 females, A. Přidal lgt., det. et coll., 31 males, 2 females, M. Říha coll., 1 male, 1 female, coll. Moravian Museum Brno, M. Říha lgt. et det., 1.viii.2019, 17 females, A. Přidal lgt., det. et coll.

Epeolus variegatus (Linnaeus, 1758). Moravia, Oslavany, 2.viii.2017, 1 male, 29 females, M. Říha lgt. det. et coll., 24.vii.2019, 1 female, A. Přidal lgt., det. et coll., 1 male, M. Říha coll., 1 male, 1 female, Moravian Museum Brno coll., M. Říha lgt. et det., 1.viii.2019, 12 males, A. Přidal lgt., det. Et coll., 2 males, M. Říha lgt. det. et coll.

RESULTS AND DISCUSSION

The loess wall and density of nests at the discovered nesting site in Oslavany are depicted on Figure 1. So large nesting site *C. inexpectatus* without presence of the sibling species *C. daviesanus* was discovered for the first time. Both facts made it possible to collect easily identifiable males with unreliably and hardly identifiable females *C. inexpectatus* altogether (Kuhlmann and Proshchalykin 2014).

*Figure 1 The nest site in Oslavany (**A**) loess wall (**B**) detail on the nest entrances (photo A. Přidal, 24. 7. 2019)*

A **B**

C. inexpectatus in CZ was considered as regionally extinct for a long time (Straka and Bogusch 2017). Thus, the current occurrence of the species in Oslavany changes its faunistic status after the last record in the Czech Republic from 1966 (Přidal, 1999). Moreover, really high density of the species on the site enabled to deposit the most numerous material in the authors' collections in the Czech Republic for further studies.

We recorded a lot of nest parasites in immediate proximity of the nest entrances. The species (Figure 2) was identified as *Epeolus variegatus* (Linnaeus, 1758). *C. inexpectatus* as a host of this parasitic species is recorded for the first time. So far the parasite *E. variegatus* was known only at *C. daviesanus*, *C. fodiens* (Geoffroy, 1785), *C. halophilus* Verhoeff, 1943 and *C. similis* Schenck, 1853 (Gusenleitner et al. 2012, Bogusch and Hadrava 2018). These host species were not recorded on the site.

Figure 2 Epeolus variegatus on Tanacetum vulgare about 3–4 m from the nesting wall (photo A. Přidal, 1. 8. 2019)

The pollen grains brushed from scopa belong to Asteroideae; *Achillea*-type with colporus, echinate thick exine, width 24–26 µm and height 19–21 µm (Figure 3). This pollen grain was represented by 100 % of pollen spectrum in all studied pollen loads and females (Figure 4). Due to the females were visiting *Tanacetum vulgare* in immediate proximity 3–4 m from the nesting wall (Figure 5) we assume that it is pollen from this plant species. These results confirm the conclusions by Mueller and Kuhlmann (2008) about a broad oligolecty of *C. inexpectatus* on Asteroideae although we isolated from scopas of seventeen females likely only one plant species. This local monolecty was probably caused by the low plant diversity in vicinity of the nesting site. This confirmation increases reliability of previous results by Mueller and Kuhlmann (2008) about the food preferences in *C. inexpectatus* when the examined females were identified with higher reliability as it was argued above. The speciation process between *daviesanus*-*inexpectatus* was not probably influenced by differing food sources as it could been assumed according to data by Noskiewicz (1936) and Ebmer (2003) and it is known in related species group-*succinctus*: *C. succinctus* (Linnaeus, 1758), *C. halophilus* and *C. hederae* Schmidt & Westrich, 1993 (Kuhlmann et al. 2007).

*Figure 3 Pollen grains from scopa C. inexpectatus: **(A)** equatorial/cross view **(B)** detail on exina **(C)** polar/longitudinal view **(D)** detail on colporus (photo A. Přidal)*

A) **B)** **C)** **D)**

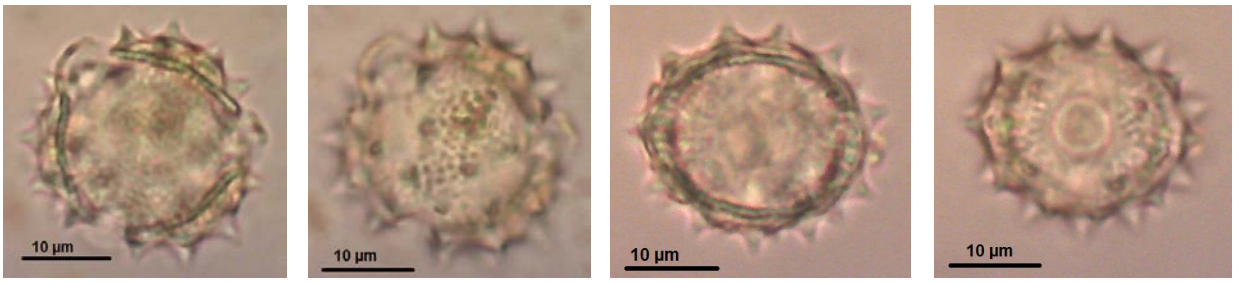

Figure 4 Field of vision – spectrum of pollen grains ***(A)*** *undyed* ***(B)*** *dyed (scale 20 µm; photo A. Přidal, 1. 8. 2019)*

A) **B)**

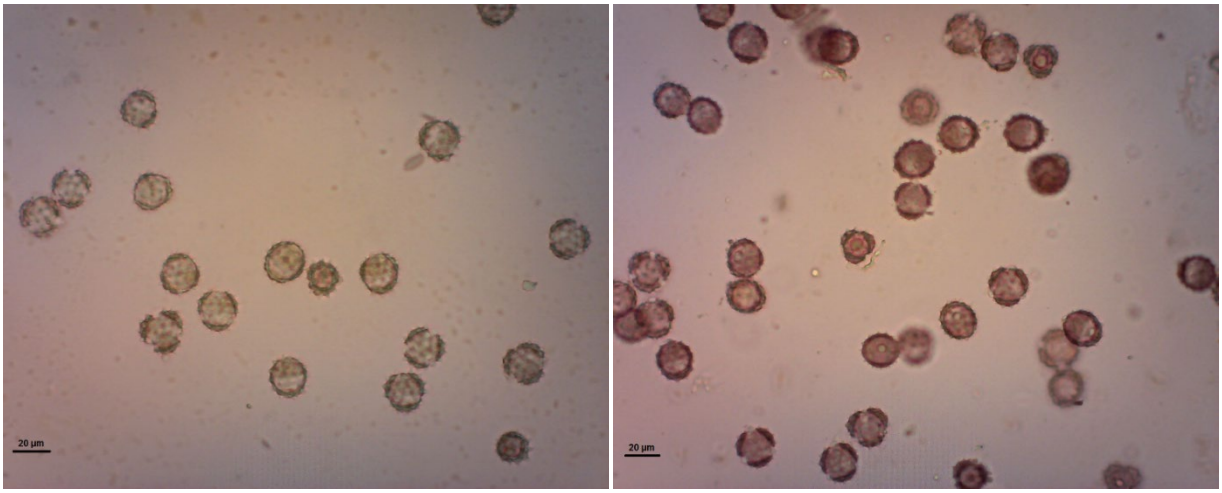

Figure 5 Female of Colletes inexpectatus on Tanacetum vulgare (photo A. Přidal, 1. 8. 2019)

CONCLUSION

We conclude following notes to the bionomy of *Colletes inexpectatus*:

1. *C. inexpectatus* is currently confirmed for the Czech Republic (Moravian part) after 61 years. The species was still missing and regionally extinct in the Czech Republic. We propose to classify the species threat as "critically endangered" (CR) for the Czech Republic due to the current occurrence at just one known locality.

2. *E. variegatus* can be newly considered as a nest parasite of *C. inexpectatus* due to its high occurrence in the immediate proximity to the nest site of *C. inexpectatus* without presence other host species (*C. daviesanus*, *C. fodiens*, *C. similis* and *C. halophilus*).

3. The studied females of *C. inexpectatus* collected and brought in nests the pollen only from *Tanacetum vulgare*. This finding is consistent with recent study confirming a broad oligolecty on Asteroideae and rejects the assumptions about oligolecty on Fabaceae.

The discovery of the nest site of *C. inexpectatus*, where the sibling species *C. daviesanus* is missing, is important for next research in the bionomy and morphology of *C. inexpectatus*. The nest site needs some legal habitat protection.

ACKNOWLEDGEMENTS
The research was financially supported from the donations by elitbau, Ltd. and Konica Minolta Business Solution Czech, Ltd.

REFERENCES

Banaszak, J. 2003. "Góry Pieprzowe" Hills in the vicinity of Sandomierz (SE Poland) as the European refuge of xerothermic bees (Hymenoptera: Apoidea). Polskie Pismo Entomologiczne, 72: 111–130.

Bogusch, P., Hadrava, J. 2018. European bees of the genera *Epeolus* Latreille, 1802 and *Triepeolus* Robertson, 1901 (Hymenoptera: Apidae: Nomadinae: Epeolini): taxonomy, identification key, distribution, and ecology. Zootaxa, 4437(1): 1–60.

Ebmer, A.W. 2003. Hymenopterologische Notizen aus Österreich – 16. (Insecta: Hymenoptera: Apoidea). Linzer biologische Beiträge, 35(1): 313–403.

Gusenleitner, F., Schwarz, M., Mazzucco, K. 2012. Apidae (Insecta: Hymenoptera). Biosystematics and Ecology Series, 29: 9–129.

Kuhlmann, M. 2000. Katalog der paläarktischen Arten der Bienengattung *Colletes* Latr., mit Lectotypenfestlegungen, neuer Synonymie und der Beschreibung von zwei neuen Arten (Hymenoptera: Apidae: Colletinae). Linzer Biologische Beiträge, 32(1): 155–193

Kuhlmann, M., Dorn, M. 2002. Die Bienengattung *Colletes* Latreille 1802 in der Mongolei sowie Beschreibungen neuer Arten aus Sibirien und den Gebirgen Zentralasiens (Hymenoptera, Apidae, Colletinae). Beiträge zur Entomologie, 52(1): 85–109.

Kuhlmann, M., Proshchalykin, M.Y. 2011. Bees of the genus *Colletes* Latreille 1802 of the Asian part of Russia, with keys to species (Hymenoptera, Apoidea: Colletidae). Zootaxa, 3068: 1–48.

Kuhlmann, M., Proshchalykin, M.Y. 2014. The bees of the genus *Colletes* Latreille 1802 of the European part of Russia, with keys to species (Hymenoptera: Apoidea: Colletidae). Zootaxa, 3878(3): 201–247.

Kuhlmann, M. et al. 2007. Molecular, biogeographical and phenological evidence for the existence of three western European sibling species in the Colletes succinctus group (Hymenoptera: Apidae). Organisms, Diversity & Evolution, 7: 155–165.

Lukáš, J., Okáli, I.1998. Včely (Hymenoptera, Apoidea) národnej prírodnej rezervácie Devínska Kobyla a Sandberg (juhozápadné Slovensko). (Bees of the national Nature Reserve Devínska Kobyla and Sandberg (southwestern Slovakia). Zborník Slovenského národného múzea, Prírodné Vedy, 44: 8–32 (in Slovak with English abstract).

Mueller, A., Kuhlmann, M. 2008. Pollen hosts of western palaearctic bees of the genus *Colletes* (Hymenoptera: Colletidae): the Asteraceae paradox. Biological Journal of the Linnean Society, 95(4): 719–733.

Noskiewicz, J. 1936. Die paläarktischen *Colletes*-Arten. Prace Naukowe Wydawnictwo Towarzystwa Naukowego we Lwowie, 3: 1–531.

Proshchalykin, M.Y., Kuhlmann, M. 2012. The bees of the genus *Colletes* Latreille 1802 of the Ukraine, with a key to species (Hymenoptera: Apoidea: Colletidae). Zootaxa, 3488: 1–40.

Přidal, A. 1999. Bee-species *Colletes inexpectatus* Noskiewicz, 1936 – species revocata (Hymenoptera: Colletidae). Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis (Brno), 47(1): 55–60.

Přidal, A. 2001. Annotated check-list of the bees from the Czech Republic and Slovakia – 1st. part (Hymenoptera: Apoidea, Colletidae). Sborník Přírodovědného klubu v Uherském Hradišti, 6: 139–163.

Straka, J., Bogusch, P. 2017. Anthophila (včely). – In. Hejda et al. [eds.] Red List of threatened species of the Czech Republic. Invertebrates. Příroda, 36: 236–249.

Szczepko, K. et al. 2002. Apoidea (Hymenoptera) in habitats of former agriculture area in a renaturization stage of Kampinos National Park (Poland). Fragmenta Faunistica, 45: 115–122.