

First confirmation of variegated molehopper *Xya variegata* (Latreille, 1809) (Orthoptera: Tridactylidae) occurring in Slovenia

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Abstract. The occurrence of the variegated molehopper *Xya variegata* in Slovenia is confirmed unambiguously for the first time, based on observations of adults and larvae on 24. 3. 2023 and 2. 6. 2023 on the banks of a gravel pit along the Mura River, east of Petišovci in the Prekmurje region, northeastern Slovenia. Thus, the previously doubtful inclusion of the species in the checklist of Slovenian Orthoptera is now justified. Further research is needed to improve knowledge of its distribution and biology. A detailed assessment of the threat status and planning of conservation measures for this threatened and ecologically highly specialised grasshopper species should also be carried out.

Key words: grasshoppers, Caelifera, *Xya*, distribution, threat status, Slovenia

Izvelek. Prva potrditev pojavljanja pisane krtovke *Xya variegata* (Latreille, 1809) (Orthoptera: Tridactylidae) v Sloveniji – Pojavljanje pisane krtovke *Xya variegata* v Sloveniji je bilo prvič nedvoumno potrjeno z opazovanjem odraslih osebkov in ličink dne 24. 3. 2023 in 2. 6. 2023 na obrežju gramoznice ob reki Muri, vzhodno od Petišovcev v Prekmurju, severovzhodna Slovenija. S tem je doslej dvomljiva uvrstitev vrste na seznam kobilic Slovenije upravičena. Za izboljšanje znanja o razširjenosti in biologiji vrste so potrebne nadaljnje raziskave, tako kot tudi ocena stopnje ogroženosti in načrtovanje ohranitvenih ukrepov za to ogroženo, ekološko zelo specializirano vrsto kobilic.

Ključne besede: kobilice, kratkotipalčnice, *Xya*, razširjenost, ogroženost, Slovenija

Introduction

The genus *Xya* is represented in Central Europe by two species, viz. Pfaendler's molehopper *X. pfaendleri* (Harz, 1970) and colourful molehopper *X. variegata* (Latreille, 1809). Both are only a few millimetres in size, their colouration is dark brown to black, with varying pattern of light markings. With their very peculiar appearance, they somewhat resemble tiny mole crickets. They are ecologically highly specialised grasshopper species with modified forelegs for digging typical small sand galleries and tunnels on the banks of various types of standing waters and rivers. With some experience, the colourful molehopper is rather easily distinguished from its



congener by a different pattern and more pronounced whitish markings on the thorax, terga, and legs. The lateral lobes of the pronotum have a characteristic wide whitish margin ventrally, whereas in Pfaendler's molehopper the pronotum is uniformly black with a coppery sheen and a very small light pronotum marking usually restricted to its posterior ventrolateral margin only (Zechner 2017a, 2017b; Bellmann et al. 2019; Iorio et al. 2019).

While Pfaendler's molehopper is more common in Slovenia and is currently known from nearly 40 localities in the northeastern and southeastern parts of the country (M. Bedjanič, unpubl.), the occurrence of the colourful molehopper in Slovenia has been considered dubious and has not been unambiguously confirmed so far (e.g. Gomboc et al. 2000, 2006). The presence of the species in western Slovenia, without concrete faunistic data or specimens in collections, was indicated in the monograph *Fauna of Orthopteroidea in Slovenia* by Us (1992) as »... In Slovenia they are in Primorska region«. It is important to note that the manuscript for the mentioned monograph was submitted just before the author's death in 1976 and was published posthumously a decade and a half later (Us 1992). In his brief description of the species under the old name *Tridactylus variegatus*, the characters of both mentioned *Xya* species can be recognized, so it is likely that the description of *X. pfaendleri* by K. Harz in 1970 (Harz 1970) was not known to the author at the time the manuscript was being prepared.

Based on the general statement mentioning the occurrence of the colourful molehopper in the Primorska region (Us 1992), it was included in the first Red List of endangered Orthopteroidea in Slovenia as »Insufficiently known« (Matvejev 1992). The statement by Us (1992) was repeated in Gomboc (2003), and subsequently the species was also included in the checklist of Orthoptera in Slovenia (Gomboc & Šegula 2014). However, in the recent comprehensive reviews of the grasshopper fauna of e.g. Vipavska dolina and Slovenian Istria in western Slovenia, the colourful molehopper was not listed (Gomboc 2013, 2019), with searches in other parts of Slovenia in the past not yielding any results either.

Material and methods

With the specific aim of studying the distribution and phenology of *Xya* grasshoppers, I visited some gravel pits in the Prekmurje region in spring 2023, including the Lakoš gravel pit (WGS84 Lat./Long.: 46.532140 °N, 16.418997 °E; alt. 162 m) along the Mura River, 1.6 km east of Petišovci, very close to the Croatian border. The gravel pit covers about 14.7 ha, it is filled with groundwater and has been abandoned a few years ago after the cessation of commercial gravel extraction that had started app. two decades ago. In its northern and northeastern portions, the banks are sparsely vegetated, with extensive areas of bare sandy and gravelly ground and southern exposure, providing an ideal habitat for molehoppers (Fig. 1).

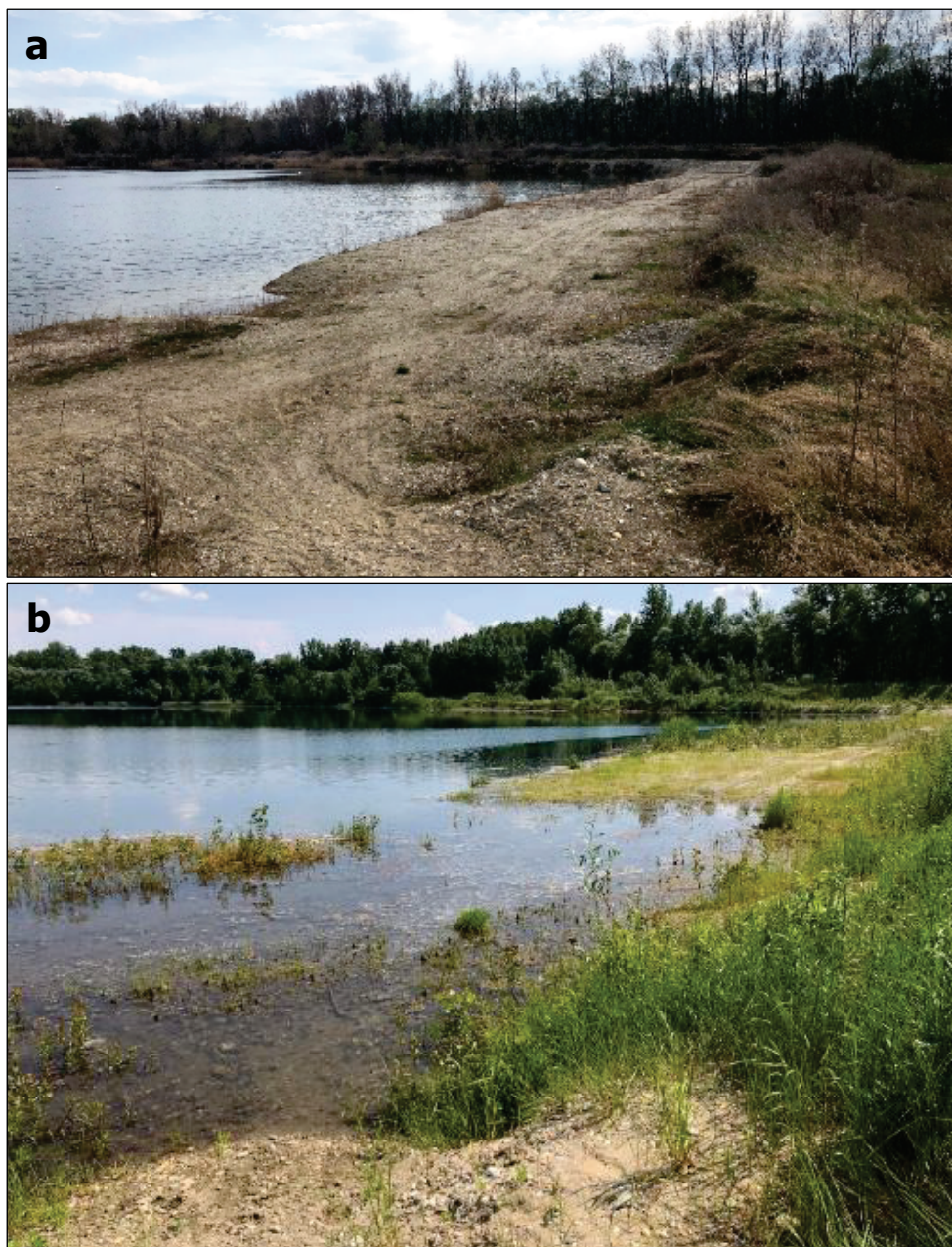


Figure 1. Lakoš gravel pit along the Mura River near Petišovci in Prekmurje region, where the variegated molehopper *Xya variegata* was observed in late March and early June 2023: (a) 24. 3. 2023, (b) 2. 6. 2023 (photo: M. Bedjanič).

Slika 1. Gramoznica Lakoš ob reki Muri v bližini Petišovcev v Prekmurju, kjer je bila pisana krtovka *Xya variegata* opazovana konec marca in v začetku junija 2023: (a) 24. 3. 2023, (b) 2. 6. 2023 (foto: M. Bedjanič).

The locality was visited twice, on the afternoon of 24. 3. 2023 when the weather was partly cloudy with a pleasant temperature of 23 °C, and on 2. 6. 2023 in the afternoon when it was mostly sunny and windy, at 25 °C. On both occasions, the northeastern banks of the gravel pit were examined for molehoppers by careful visual inspection of suitable patches, aided by Pentax Papilio II binoculars (8.5 × 21, macro focusing distance 50 cm).

Results and discussion

The targeted survey for the presence of *Xya* grasshoppers at Lakoš gravel pit on 24. 3. 2023 soon revealed signs of molehoppers' presence in the form of typical small sand galleries. Only a moment later, to the great surprise and excitement of the observer, the first individual of *X. variegata* was sighted and photographed. Syntopically, *X. pfaendleri* was also observed. In total, I observed 5 adult individuals and 5 larvae of the colourful molehopper and 30 adult individuals and 20 larvae of Pfaendler's molehopper. I revisited the Lakoš gravel pit on 2. 6. 2023. Colonies of both *X. variegata* and *X. pfaendleri* were sighted in the northeastern part of the gravel pit. Individuals of both species, larvae and adults, shared the same patches of suitable habitat, with no apparent interactions or aggression (Figs. 2, 3).



Figure 2. Variegated molehopper *Xya variegata* – adult individual at Lakoš gravel pit near Petišovci, on 2. 6. 2023 (photo: M. Bedjanič).

Slika 2. Pisana krtovka *Xya variegata* – odrasel osebek pri gramoznici Lakoš v bližini Petišovcev, dne 2. 6. 2023 (foto: M. Bedjanič).



Figure 3. Syntopic occurrence of variegated molehopper *Xya variegata* and Pfaendler's molehopper *X. pfaendleri* at Lakoš gravel pit near Petišovci on 2. 6. 2023 - larva of *X. variegata* (left) and two adult individuals of *X. pfaendleri* (right) (photo: M. Bedjanič).

Slika 3. Sintopično pojavljanje pisane krtočke *Xya variegata* in pritlikave krtočke *X. pfaendleri* v gramoznici Lakoš v bližini Petišovcev dne 2. 6. 2023 – ličinka *Xya variegata* (levo) in dva odrasla osebka *X. pfaendleri* (desno) (foto: M. Bedjanič).

In total, I observed between 50 and 100 adult individuals and larvae of the colourful molehopper, as well as 50–100 adult individuals and larvae of Pfaendler's molehopper. Of the other orthopterans, a few undetermined Tetrigidae individuals and numerous larvae and adults of the marsh cricket *Pteronemobius heydenii* (Fischer, 1853) were recorded. For *X. variegata*, these are the first confirmed faunistic records from Slovenia (Fig. 4). Thus, the previously doubtful inclusion of the species in the checklist of Slovenian Orthoptera is now justified.

Based on the known European range of the colourful molehopper (Harz 1975; Hochkirch et al. 2016a; Bellmann et al. 2019; Iorio et al. 2019), its occurrence in Slovenia was expected. The new records from northeastern Slovenia are not extremely surprising, as the species has already been recorded in neighbouring countries on the eastern outskirts of the Pannonian Lowlands. In Austria, *X. variegata* was found for the first time at around the turn of the millennium (Berg et al. 2000). Since then, supplementary records have been added. The species is largely restricted to the Austrian Pannonian region, with two additional isolated sites in the Lafnitz River valley in Styria and Southern Burgenland (Russ 2006; Zechner 2017b). According to Skejo et al. (2018), it is known with certainty in Croatia from two localities in Hrvatsko Zagorje. Scattered old records from the former Yugoslavia and the Balkan Peninsula (e.g. Us 1938, 1964; Us & Matvejev 1967) should be revised, as Pfaendler's molehopper, which occurs in eastern and southeastern Europe and further to the east, was described only in 1970 (Harz 1970). Additionally, in parts of eastern and southeastern Europe, both species are sympatric and occasionally syntopic (e.g. Harz 1975; Berg et al. 2000; Russ 2006; Zechner 2017b). Records from Slovenia (Gomboc et al. 2000; M. Bedjanič, unpubl.) and elsewhere (e.g. Harz 1970, 1975; Pavićević et al. 2014; Zehner et al. 2017a; Ivković et al. 2018; Puskás et al. 2018; Čato & Zagorac 2021) suggest that Pfaendler's molehopper is the more common of the two species in the lowlands of the wider Pannonian region.

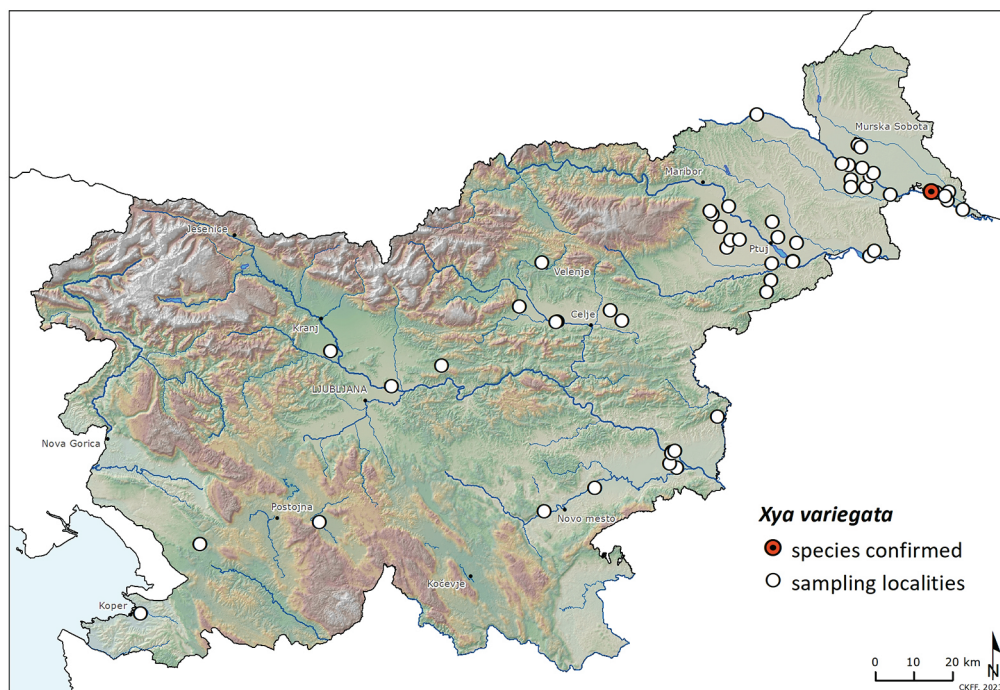


Figure 4. Distribution map of variegated molehopper *Xya variegata* in Slovenia, with white circles indicating the localities visited by the author between September 2021 and June 2023, at which the species was not recorded despite the targeted search.

Slika 4. Zemljevid razširjenosti pisane krtočke *Xya variegata* v Sloveniji. Beli krožci ponazarjajo lokalitete, ki jih je avtor obiskal med septembrom 2021 in junijem 2023 in kjer vrsta kljub ciljnemu iskanju ni bila zabeležena.

Due to its wide distribution from North Africa and Mediterranean Europe to South-East Asia and locally abundant occurrences in some parts of southern Europe, the colourful molehopper is listed as a Least Concern (LC) species in the European Red List of Grasshoppers, Crickets and Bush-crickets (Hochkirch et al. 2016b). However, regional differences and generally decreasing population trend are noted (Hochkirch et al. 2016a). For example, it is Extinct (EX) in Switzerland (Hochkirch 2016a), in the whole of Austria it is considered Data Deficient (DD) (Zechner 2017b), while in Styria it has recently been assessed as a Critically Endangered (CR) species (Zechner et al. 2021).

Hitherto the only known locality of *X. variegata* in Slovenia is located within the Natura 2000 site Mura (SI3000215) and the transboundary Mura-Drava-Danube UNESCO Biosphere Reserve, so at least formally some degree of the species' habitat protection and appropriate management should be ensured. However, due to the lack of the formal legal status of this tiny grasshopper species as highly threatened regionally and in Slovenia, conservation efforts confronting potential threats may prove to be difficult. Although further targeted fieldwork and research is needed for a detailed assessment of its threat status and planning of conservation measures, it is certain that *X. variegata* will be listed among endangered species in a badly needed update of the *Red List of Threatened Animal Species* in Slovenia.

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References

- Bellmann H, Rutschmann F, Roesti C, Hochkirch A. 2019. Der Kosmos Heuschrecken-führer: Die Heuschrecken Mitteleuropas und die wichtigsten Arten Südosteuropas. Stuttgart (DE): Franckh-Kosmos Verlags-GmbH & Co. KG.
- Berg HM, Gross H, Paill W. 2000. Die Dreizehenschrecke *Xya variegata* Latreille, 1809 (Orthoptera, Tridactylidae), neu für Österreich. Beiträge zur Entomofaunistik. 1: 3-8.
- Čato S, Zagorac D. 2021. Unexpected faunistic records of *Rhacocleis annulata*, *Eyprepocnemis plorans*, and *Xya pfaendleri* (Orthoptera) from Croatia and Slovenia. Natura Croatica. 30: 501-511. doi: [10.20302/NC.2021.30.33](https://doi.org/10.20302/NC.2021.30.33)
- Gomboc S. 2003. Kobilice – Orthoptera (Saltatoria). In: Sket B, Gogala M, Kuštor V, editors. Živalstvo Slovenije. p. 308-318. Ljubljana (SI): Tehniška založba Slovenije.
- Gomboc S. 2013. Kobilice. In: Pavšič J, editor. Vipavska dolina: neživi svet, rastlinstvo, živalstvo, zgodovina, umetnostna zgodovina, gmotna kultura, gospodarstvo, naravovarstvo, Ljubljana (SI): Slovenska matica. p. 136-145.
- Gomboc S. 2019. Kobilice. In: Pavšič J, Gogala M, Seliškar A, editors. Slovenska Istra I – Neživi svet, rastlinstvo, živalstvo in naravovarstvo. Ljubljana (SI): Slovenska matica. p. 220-233.
- Gomboc S, Šegula B. 2014. Pojoče kobilice Slovenije: priručnik za določanje pojočih vrst kobilic po napevih in slikah / Singing Orthoptera of Slovenia: manual for identification of singing Orthoptera based on songs and images. Ljubljana (SI): EGEA (European Geography Association), Zavod za naravo.
- Gomboc S, Bedjanič M, Šegula B. 2006. Pregled dosedanje raziskanosti kobilic v Sloveniji (Insecta, Orthoptera). In: Prešern J, editor. 1. Slovenski entomološki simpozij, Knjiga povzetkov, 4. in 5. november 2006. Ljubljana (SI): Slovensko entomološko društvo Stefana Michielija in Prirodoslovni muzej Slovenije. p. 18.
- Gomboc S, Zechner L, Bedjanič M. 2000. *Xya pfaendleri* (Harz, 1970) auch in Slowenien (Orthoptera, Tridactylidae). Acta Entomologica Slovenica. 8(2): 129-136.
- Harz K. 1970. Orthopterologische Beiträge VIII. *Tridactylus pfaendleri* nov. spec. Nachrichtenblatt der Bayerischen Entomologen. 19: 56-59.
- Harz K. 1975. Die Orthopteren Europas II. The Orthoptera of Europe II. In: Series Entomologica. Vol. 11. The Hague (NL): Dr. W. Junk.

- Hochkirch A, Sirin D, Presa JJ, Chobanov DP, Puskas G, Dusoulier F, Lemonnier-Darcemont M, Iorgu IS, Monnerat C, Ivkovic S, Korsunovskaya O, Willemse LPM, Rutschmann F, Kleukers R, Kristin A, Szovenyi G. 2016a. *Xya variegata* (Europe assessment). The IUCN Red List of Threatened Species 2016: e.T68486396A74625447; [accessed 3. 6. 2023]. <https://www.iucnredlist.org/species/68486396/74625447>
- Hochkirch A, Nieto A, García Criado M, Cálix M, Braud Y, Buzzetti FM, Chobanov D, Odé B, Presa Asensio JJ, Willemse L et al. 2016b. European Red List of Grasshoppers, Crickets and Bush-crickets. Luxembourg (LU): Publications Office of the European Union.
- Iorio C, Scherini R, Fontana P, Buzzetti FM, Kleukers R, Odé B, Massa B. 2019. Grasshoppers and crickets of Italy: A photographic field guide to all the species. WBA Handbooks. 10: 1-578.
- Ivković S, Pantović U, Skejo J. 2018. Ovčar–Kablar Gorge (SW Serbia) – a new hotspot of Orthoptera diversity. Annales de la Société entomologique de France (N.S.). 54(3): 257-272. doi: [10.1080/00379271.2018.1474136](https://doi.org/10.1080/00379271.2018.1474136)
- Matvejev SD. 1992. Rdeči seznam ogroženih ravnokrilcev (Orthopteroidea) v Sloveniji. Varstvo narave. 17: 123-129.
- Pavičević D, Ivković S, Horvat L. 2014. New and rare species of orthopteroid insects in the fauna of Serbia. Fauna Balkana. 3: 103-122.
- Puskás G, Nagy B, Szövényi G. 2018. Faunistical data to the Croatian Orthoptera with four species newly recorded in the country. Annales de la Société entomologique de France (N.S.). 54(6): 539-558. doi: [10.1080/00379271.2018.1530071](https://doi.org/10.1080/00379271.2018.1530071)
- Russ M. 2006. Die Dreizehenschrecke *Xya variegata* Latreille, 1809 und die Grüne Strandschrecke *Aiolopus thalassinus* Fabricius, 1781 – zwei bemerkenswerte Funde im Lafnitztal (Orthoptera). Beiträge zur Entomofaunistik. 7: 154-157.
- Skejo J, Rebrina F, Szövényi G, Puskás G, Tvrtković N. 2018. The first annotated checklist of Croatian crickets and grasshoppers (Orthoptera: Ensifera, Caelifera). Zootaxa. 4533(1): 1-95. doi: [10.11646/ZOOTAXA.4533.1.1](https://doi.org/10.11646/ZOOTAXA.4533.1.1)
- Us PA. 1938. Doprinos poznavanju ortopterske faune u Jugoslaviji. Ljubljana(SI): Prirodoslovne Razprave SAZU - Slovenska Akademija Znanosti in Umetnosti. 3(9): 239–252
- Us PA. 1964. Ortopterska fauna otoka Cresa i Lošinja. Biološki glasnik. 17: 17-30.
- Us PA. 1992. Favna ortopteroidnih insektov Slovenije. SAZU - Slovenska Akademija Znanosti in Umetnosti. Razred za prirodoslovne vede. 32(12): 1-314.
- Us PA, Matvejev S. 1967. Orthopteroidea. Catalogus faunae Jugoslaviae III/6. Ljubljana (SI): Slovenska Akademija Znanosti in Umetnosti.
- Zechner L. 2017a. Pfändlers Grabschrecke *Xya pfaendleri* Harz, 1970. In: ZunaKratky T, Landmann A, Illich I, Zechner L, Essl F, Lechner K, Ortner A, Weißmair W, Wöss G, editors. Die Heuschrecken Österreichs. Denisia 39. Linz (AT): Biologiezentrum des Oberösterreichischen Landesmuseums. p. 489-492.
- Zechner L. 2017b. Gefleckte Grabschrecke *Xya variegata* Latreille, 1809. In: Zuna Kratky T, Landmann A, Illich I, Zechner L, Essl F, Lechner K, Ortner A, Weißmair W, Wöss G, editors. Die Heuschrecken Österreichs. Denisia 39. Linz (AT): Biologiezentrum des Oberösterreichischen Landesmuseums. p. 493-496.

Zechner L, Stani W, Zuna-Kratky T. 2021. III. Heuschrecken (Orthoptera) und Fangschrecken (Mantodea). In: ÖKOTEAM, Rote Listen der Tiere der Steiermark, Teil 2A, Tiergruppenbearbeitungen (1/2). Unveröff. Projektbericht i.A. der Österreichischen Naturschutzjugend für das Land Steiermark. Naturschutz. Graz (AT): ÖKOTEAM. p. 65-159.



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