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NEW RECORDS OF *Aedes (Rusticoidus) rusticus* (ROSSI, 1790) (DIPTERA, CULICIDAE) FROM FRIULI VENEZIA GIULIA REGION (NORTHERN ITALY)

NUOVI REPERTI DI *Aedes (Rusticoidus) rusticus* (ROSSI, 1790) (DIPTERA, CULICIDAE) IN FRIULI VENEZIA GIULIA (ITALIA SETTENTRIONALE)

Riassunto breve - Si descrive il nuovo reperimento in Friuli Venezia Giulia del Culicide *Aedes (Rusticoidus) rusticus*, avvenuto all'interno di un'area boschiva del Carso triestino. L'habitat larvale era costituito da uno stagno di origine piovana, ad una quota di 150 m s.l.m. e distante circa 340 m dal mare. Le osservazioni hanno confermato che la specie è univoltina con svernamento allo stadio di larva e sfarfallamento degli adulti in aprile e maggio. Si riportano alcuni dati di morfologia larvale. È di 39 il numero di specie di Culicidi censite nella regione Friuli Venezia Giulia.

Parole chiave: *Aedes rusticus*, Diptera, Culicidae, Zanzare, Italia, Friuli Venezia Giulia, Carso.

Abstract - We report a new finding of the mosquito *Aedes (Rusticoidus) rusticus* from the Friuli Venezia Giulia region (northern Italy). The larvae were found in a semi-temporary rain pool located in a wooded area of the Karst, 340 m far from the Adriatic Sea coast, in the province of Trieste. The species was univoltine overwintering at the stage of larva. Adult emergence took place in April-May. Some morphological features of the fourth instar larvae (L_4) are provided. The updated checklist of the culicids of the Friuli Venezia Giulia region includes a total of 39 species.

Key words: *Aedes rusticus*, Diptera, Culicidae, Mosquitoes, Italy, Friuli Venezia Giulia, Karst.

Introduction

During an investigation on the mosquito fauna of Trieste's Karst area (Friuli Venezia Giulia, North-eastern Italy), larvae of the species *Aedes rusticus* (ROSSI 1790) were detected.

Ae. rusticus has a large northern Palaearctic distribution area which extends from Scotland and Scandinavia to northern Africa and Asia Minor (GUTSCEVICH et al. 1974; BECKER et al. 2010; ROBERT et al. 2019). Its Italian distribution is poorly known. The first record dates back to 1790 when P. Rossi found it in the Pisa area (Tuscany region) and classified it under the binomial *Culex rusticus* (Rossi, 1790). Afterwards, it was mentioned by Coluzzi and Coluzzi (1967) in a study focused on the mosquito fauna of the Apennine Mountains but only as "known species" for Italy with no other geographical specifications. Later it was reported from two coastal areas of central Italy of prevalent Mediterranean profile, i.e. the Macchia Lucchese (Tuscany region) (RIVOSECHI & KHOURY 1986; BALDACCINI & GIANCACCINI 1993) and the Parco del Circeo (Lazio region) (DE LIBERATO et al. 2015; Luciano Toma, pers. comm.), re-

spectively. In Friuli Venezia Giulia, the presence of *Ae. rusticus* was generically mentioned for the Lagoon of Marano and Grado (provinces of Gorizia and Udine) in a list of species sampled for sanitary purposes at national level (TOMA et al. 2008).

Ae. rusticus is described as an univoltine species overwintering at the larval stage in woodland pools and ditches of various origin (snow melting or rain); it is a strong man biter but it has little importance as a vector of pathogens (GUTSCEVICH et al. 1974; BECKER et al. 2010).

Materials and methods

In 2019-2021 collections of mosquitoes were carried out in potential breeding sites of the Trieste's Karst.

Study area

The Trieste's Karst is a calcareous elongated area of about 100 km² situated along the northern Adriatic Sea coast (Fig. 1). Its climate is sub-Mediterranean (average temperature 15.5 °C, precipitation about 1000 mm)



Fig. 1 - Study area (Karst, province of Trieste, Friuli Venezia Giulia region) and discovery site of *Aedes rusticus*.
- Area della ricerca (Carso, Trieste, Friuli Venezia Giulia) e sito di reperimento di *Aedes rusticus*.

next to the Adriatic Sea, becoming progressively more continental (average temperature 12.7 °C, precipitation about 1300 mm) moving onto the internal plateau up to 400 m a.s.l. Most rainfalls occur in late spring and autumn. An important climatic factor of this area is the Bora wind which makes the air and the soils dry (ARPA FVG - OSMER 2014).

Because of the Bora wind and the nature of the soil, the availability of stagnant superficial water bodies, and thus of mosquito larval habitats, is generally scarce. The vegetation is Mediterranean near the coast; but it becomes sub-alpine on the internal plateau, where it is composed of small trees (e.g. *Ostrya carpinifolia*, *Fraxinus ornus*, *Quercus pubescens*) and shrubs (e.g. *Cotinus coggygria*) (REGIONE AUTONOMA FRIULI VENEZIA GIULIA 2012).

Sampling

Larvae and pupae of the mosquitoes were sampled by means of a 500 ml dipper, preserved in 70 % ethanol and identified at the stereomicroscope. Some larvae were taken to the laboratory and reared up to the adult stage. The adults were dry preserved. Some larvae and male hypopygia were mounted and identified on slides.

Identification

The identification to species level was undertaken in accordance to the keys of GUTSEVICH et al. 1974, SEVERINI et al. 2009 and BECKER et al. 2010.

The nomenclature and the classification adopted in this paper refer to WILKERSON et al. 2015.



Fig. 2 - Pre-imaginal habitat of *Aedes rusticus* in December 2020.
- Habitat di sviluppo pre-imaginale di *Aedes rusticus* nel dicembre 2020.

Results and Discussion

In February 2020 a large monospecific population of *Ae. rusticus* was found in the locality of San Primo (Sv. Primož), Santa Croce (Križ), municipality of Trieste, 6 Km far from the Slovenian border (Fig. 1). The larval habitat was a temporary pond (45° 43' 27.78" N, 13° 41' 52.52" E), about 8 m² large and 30 cm deep (Fig. 2), located at the altitude of 150 m a.s.l., 340 m far from the Adriatic Sea coast; it was bordered with trees of *Quercus pedunculata*, *Fraxinus ornus* and *Pinus nigra* and bottomed with dead leaves.

The first collection of 2nd and 3rd instars larvae (L₂-L₃) took place on February 2nd; the first pupae appeared at the end of February and the adult emergence was completed by the end of May, when the pond dried up. In the same year, new-hatched first instar larvae (L₁) were detected on December 12th after a rain flooding.

In 2021, on January 9th and on January 15th, L₃ and L₄ were sampled, respectively; the first pupae appeared at the end of March and the adult emergence completed by the end of April. Then, the pond dried by the end of June and it was still dry at the end of October 2021.

In May-June 2021 the pond before drying was colonized by larvae of *Culiseta annulata* (SCHRANK, 1776). In both years of the study, during the time of the pre-imaginal development of *Ae. rusticus* the water temperature ranged from 3.6 to 11.7 °C and the water pH ranged from 7.4 to 7.6.

Biting females were captured near the breeding site until middle May.

Altogether about a hundred larvae of *Ae. rusticus* were sampled from which about 30 adults of both sexes were obtained in laboratory.

A total of 35 larvae and 30 adults (10 males and 10 females) were singularly identified by checking the presence of the main diagnostic morphological features. The L₄ has the siphon with three or four pairs of dor-



Fig. 3 - *Aedes rusticus* larva (L_4). Abdomen. Terminal segments. The siphonal pecten has 17-24 teeth plus 1-3 teeth detached beyond the siphonal tuft (1-S).
- Larva di *Aedes rusticus* (L_4). Segmenti terminali. Il pettine sifonico presenta 17-24 denti seghettati più 1-3 denti inseriti oltre il ciuffo di setole sifoniche (1-S).

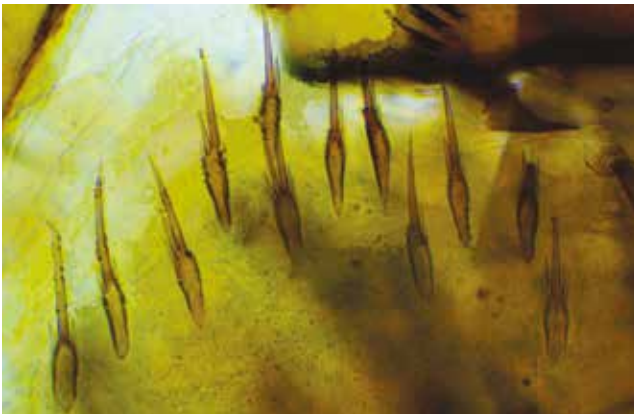


Fig. 4 - *Aedes rusticus* larva (L_4). Abdomen, VIII segment. The comb scales (12-16) have a stronger median spine.
- Larva di *Aedes rusticus* (L_4). Addome, VIII segmento. Le scaglie del pettine (12-16) presentano una spina mediana ben distinta.



Fig. 5 - *Aedes rusticus* larva (L_4). Siphonal pecten: the basal and median teeth bear 1-2 lateral denticles.
- Larva di *Aedes rusticus* (L_4). Pettine sifonico: i denti basali e mediani presentano 1-2 denticoli laterali.

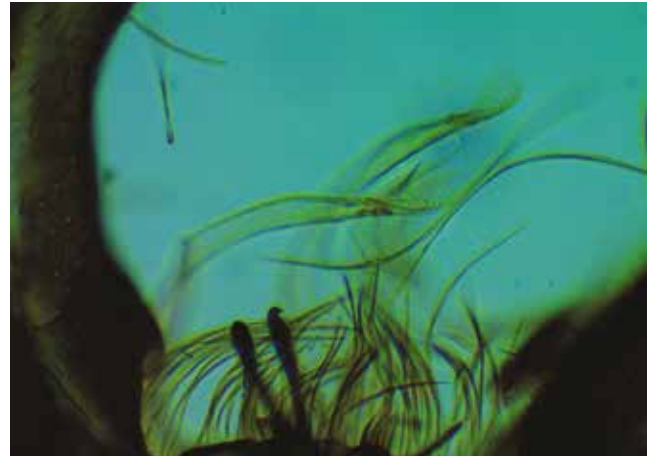


Fig. 6 - *Aedes rusticus*. Male hypopygium. The claspette are transversely striated.
- *Aedes rusticus*. Genitali del maschio. Le claspette sono trasversalmente striate.



Fig. 7 - *Aedes rusticus*. Male hypopygium. The apical spine of the gonostyle is S-shaped.
- *Aedes rusticus*. Genitali del maschio. La spina apicale del gonostilo ha forma di S.

	N. larvae examined	Average number	S.D.	Min	Max
Frontal setae branches					
internal (5-C)	30	3,23	0,43	3	4
median (6-C)	32	2,09	0,30	2	3
outer (7-C)	32	7,03	0,86	6	9
Antennal seta (1-A) branches	32	5,06	0,63	4	6
Siphonal seta (1-S) branches	31	6,68	0,75	5	8
Pre-cratal setae (4-X)	32	4,00	0,62	3	6
Cratal setae (4-X)	31	15,42	1,31	12	18
Comb scales	29	14,00	1,64	12	16
Pecten teeth	31	21,19	1,92	17	24
Teeth beyond the pecten	31	1,90	0,47	1	3
Siphonal index	31	3,30	0,16	3,02	3,64
Papillae/saddle index	31	0,81	0,10	0,57	1,05

Tab. I - Morphological features of *Aedes rusticus* larva (L_4).
- Caratteri morfologici della larva (L_4) di *Aedes rusticus*.

sal setae and it has the pecten with one to three more spaced teeth inserted beyond the tuft (Fig. 3). The comb scales (12-16) have a stronger median spine (Fig. 4). The siphonal pecten has 17-24 teeth plus 1-3 teeth detached beyond the siphonal tuft; the basal and median teeth bear lateral 1-2 denticles (Fig. 5). More morphological features of the L_4 are reported in Tab. I. The adults have no pale rings on the tarsi and have tergites with pale transverse bands broadened medially. The male hypopygium has the basal lobe bearing lanceolate setae, the claspette are transversely striated (Fig. 6) and the apical spine of the gonostyle is S-shaped (Fig. 7).

Species	Sites of sampling	Sampled stages
<i>Anopheles plumbeus</i> STEPHENS, 1828	Numerous	L, P, A
<i>Aedes albopictus</i> (SKUSE, 1894)	Numerous	L, P, A
<i>Aedes geniculatus</i> (OLIVIER, 1791)	Numerous	L, P, A
<i>Aedes koreicus</i> (EDWARDS, 1917)	Numerous	L, P, A
<i>Aedes japonicus</i> (THEOBALD, 1901)	45°46'11" N, 13°42'50" E	L, P, A
	45°43'42.12" N, 13°45'01.64" E	
	45°43'3.08" N, 13°41'43.46" E	
<i>Aedes rusticus</i> (ROSSI, 1790)	45°43'27.78" N, 13°41'52.52" E	L, P, A
<i>Aedes vexans</i> (MEIGEN, 1830)	Numerous	L, P, A
<i>Culex pipiens</i> LINNAEUS, 1758	Numerous	L, P, A
<i>Culiseta annulata</i> (SCHRANK, 1776)	45°43'27.78" N, 13°41'52.52" E	L, P, A
<i>Culiseta longiareolata</i> (MACQUART, 1838)	Numerous	L, P, A
<i>Culiseta morsitans</i> (THEOBALD, 1901)	45°43'50" N, 13°44'26" E	L
<i>Orthopodomyia pulcralpalpis</i> (RONDANI, 1872)	45°44'9" N, 13°43'26" E	L, P, A
	45°43'26" N, 13°43'8" E	

Tab. II - List of species collected during the present study in the Trieste's Karst area. L = larva; P = pupa; A = adult.
- *Elenco delle specie raccolte durante la presente ricerca nell'area del Carso triestino.* L = larva; P = pupa; A = adulto.

The list of mosquito species sampled during the present investigation in the Karst area are listed in Tab. II.

The present findings confirm the occurrence of *Ae. rusticus* in Northern Italy and add a further species to the previous published Friuli Venezia Giulia culicids checklist which is composed of a total of 39 species, while the species altogether recorded in the whole Karst area are a total of 18 (ZAMBURLINI et al. 2019; GREGO & ZAMBURLINI 2020).

The sampling results confirm that *Ae. rusticus* is a monocyclic species and that it overwinters as a larva. From a zoogeographic point of view its occurrence near the mild Mediterranean coast is most likely linked to the availability of a suitable winter-spring cold larval habitat.

Manuscript received on 26.X.2021, accepted on 12.XI.2021.

Acknowledgements

We would like to thank Andrea Colla (Museo Civico di Storia Naturale, Trieste) for collaborating in taking the photographs under the microscope and Luciano Toma (Istituto Superiore di Sanità, Rome) for the critical review of the manuscript.

Bibliografia

- ARPA FVG - OSMER 2014. *Il clima del Friuli Venezia Giulia*. http://www.meteo.fvg.it/clima/clima_fvg/02_documenti_descrittivi_e_approfondimenti/01_Il_clima_del_Friuli_Venezia_Giulia/clima_fvg-divulgativo.pdf.
- BALDACCINI, G.N., & U. GIANCACCETTI. 1993. Ulteriori note sui ditteri culicidi della Macchia Lucchese (Toscana). *Distribuzione ed ecologia degli stadi larvali*. *Frustula Entomol.* 16 (29): 23-31.
- BECKER, N., D. PETRIC, M. ZGOMBA, C. BOASE, B. MADON M., C. DAHL & A. KAISER. 2010. *Mosquitoes and their control*. 2nd ed. Heidelberg, Dordrecht, New York: Springer.
- COLUZZI, M., & A. COLUZZI. 1967. Su alcune specie di *Aedes* (Diptera Culicidae) degli Appennini e del Gargano. *Riv. Parassitol.* 28 (1): 47-61.
- DE LIBERATO, C., A. MAGLIANO, F. FARINA & L. TOMA. 2015. Recent entomological enquiry on mosquito fauna in Circeo National Park. *Ann. Ist. Super. Sanità* 51 (3): 224-8.
- GREGO, B., & R. ZAMBURLINI. 2020. First records of *Orthopodomyia pulcralpalpis* (Rondani, 1872) (Diptera, Culicidae)

- in northern Italy. *Atti Mus. Civ. St. Nat. Trieste* 61: 261-8.
- GUTSEVICH, A.V., A.S. MONCHADSKII & A.A. SHTAKEL'BERG. 1974. *Diptera vol. 3, n. 4, Mosquitoes Family Culicidae*. Fauna of the URSS. Jerusalem: I.P.S.T. (translation from Russian).
- REGIONE AUTONOMA FRIULI VENEZIA GIULIA. 2012. *Flora e vegetazione forestale. Carso*. <https://www.regione.fvg.it/rafvfg/cms/RAFVG/ambiente-territorio/tutela-ambiente-gestione-risorse-naturali/FOGLIA50/FOGLIA23/>.
- RIVISECCHI, L., & C. KHOURY. 1986. Osservazioni su alcuni Artropodi di interesse medico-veterinario in un Parco (Migliarino-S. Rossore-Massaciucoli) della Regione Toscana, con note su due aree protette (Castel Porziano e Palo Laziale) dei dintorni di Roma. *Frustula Entomol.* 7-8: 283-306.
- ROBERT, V., F. GÜNAY, G. LE GOFF, PH. BOUSSÈS, T. SULESCO, A. KHALIN, J.M. MEDLOCK, H. KAMPEN, D. PETRIĆ & F. SCHAFFNER. 2019. Distribution chart for Euro-Mediterranean mosquitoes (western Palaearctic region). *Jour. Europ. Mosquito Contr. Ass.* 37: 1-38.
- ROSSI, P. 1790. *Fauna Etrusca, Sistens Insecto quae in Provinciis Florentina et Pisana Praesertim Collegit*. Tomus Primus. Liburni: Typis Tomae Masi & Sociorum.
- SEVERINI, F., L. TOMA, M. DI LUCA & R. ROMI. 2009. Le zanzare italiane: generalità e identificazione degli adulti (Diptera, Culicidae). *Fragm. Entomol.* 41 (2): 213-372.
- TOMA L., M. CIPRIANI, M. GOFFREDO, R. ROMI & R. LELLI. 2008. Primo report sull'attività entomologica in Italia nell'ambito del piano nazionale per la sorveglianza della West Nile disease in Italia. *Veterinaria Ital.* 44 (3): 483-97.
- WILKERSON, R.C., Y.-M. LINTON, D.M. FONSECA, T.R. SCHULTZ, D.C. PRICE & D.A. STRICKMAN. 2015. Making mosquito taxonomy useful: a stable classification of Tribe Aedini that balances utility with current knowledge of evolutionary relationships. *PLoS ONE* 10 (7): e0133602.
- ZAMBURLINI, R., E. CARGNUS & P. ZANDIGIACOMO. 2019. Mosquitoes (*Diptera Culicidae*) of Friuli Venezia Giulia (north-eastern Italy): annotated checklist, geographic distribution and habitats of pre-imaginal stages. *Redia* 102: 13-21.

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