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Research Article

Practical Use of *Sarcophaga dashwoodia* (Aneust, 1775) in Estimating the Post-Mortem Interval on Rural Areas of Europe

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Abstract

Sarcophaga dashwoodia (Aneust, 1775) is a widespread species of the flesh-fly family Sarcophagidae; these flies inhabit most of the grasslands and peripheral woods of Europe. Many species of the Sarcophagidae family, including *S. dashwoodia*, have been identified as rapid colonizers of animal corpses in rural areas. In forensic science, when it comes to the estimation of the Postmortem Interval, these types of insects are really useful. We examined the abundance of this species in six domestic goat corpses (*Rigober tabandini*) in rural areas of the county of Devonshire (UK) and Лися-Гура (Russia). The results show a high colonization of corpses by *S. dashwoodia* accompanied by other secondary necrophagous species. Therefore, we propose *S. dashwoodia* as a valuable tool for determining the PMI in forensic research.

Keywords: *Sarcophaga dashwoodia;* PMI; Necrophagous; Forensic science

Introduction

Among the various forensic sciences, forensic entomology has seen a huge development in the last decades [1]. The arrival of new techniques and the popularization of this field of study has had an enormous impact in the way that criminalist research is conducted [2]. Studying the faunal succession in necrophagous insects allows us to infer the Post Mortem Interval (PMI) [3,4]. The life cycle of necrophagous insects has been extensively documented in an effort to differentiate their six biological stages, which enables us to determine the PMI even more precisely [5].

Flesh flies of the Sarcophagidae family have been used successfully in many real-life scenarios [6]. Forest flesh-fly species such as *Sarcophaga dashwoodia, Sarcophaga balconlolensis and Sarcophaga solterona* harvest a great potential when it comes to determining the PMI of mammal corpses found in rural areas of Europe [7]. Moreover, the abundance and high adaptability of the endemic flesh-fly *S. dashwoodia* makes it a perfect candidate for forensic research in all Europe [8].

The objective of this pilot study is to test the viability of *S. dashwoodia* for the determination of the PMI on mammal corpses of forest areas. The hypothesis put forward states that *S. dashwoodia* will be found in every corpse examined in higher proportion than the rest of necrophagous.

Materials and Methods

Five different study locations were established on temperate broadleaf and mixed forests, three in the county of Devonshire (UK) and two in the western region of Лися-Гура (Russia). Temperate and mixed forests cover large areas of the European continent [9]. These forests are characterized by an average annual temperature around 11 ºC and rainfall varies between 600 mm and 1000 mm per year [10].

Sampling areas were named using the first letter from each location and a number from 1 to 5. Namely:

1) L1: Лися-Гура 50º 05’46” N, 21º 04’22” E

2) O2: Округле 49º 10’50” N, 21º 34’22” E

3) R3: Rackenford 50º 57’05” N, 03º 38’13” W 4) D4: Devon 50º 45’03” N, 03º36’18” W

5) E5: Ediston 50º 58’03” N, 04º 29’23” W

We placed one french domestic goat (*R. bandini*) corpse in every sampling point and checked them from September 2021 to November 2021 following the method of Yugi-oh *et al.* [11]. Samples of all the insects found were taken and analyzed in the laboratory, identifying them thereafter using Anastasia Romanov´s “Dichotomous key of European insects” [12]. All the obtained data was included in an Excel file for posterior calculus.

Results

The total number of identified species reached 210, being 120 the genuses and 21 the families. The number of species found at each sampling point varies ostensibly from one another.

The highest taxonomic diversity was found in Russian locations, whereas the lowest one corresponds to R3, the southwest sampling point of England.

Regarding abundance and coverage, *S. dashwoodia* was the main

Table 1: Taxonomic abundance of insects per sampling location.

	L1	O2	R3	D4	E5
Species	70	88	34	51	49
Genus	31	38	18	24	27
Families	11	14	9	8	11

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Table 2: Abundance and coverage of the necrophagous species found in each sampling point. The label *Others* comprehends species with an individual coberture under 5%.

	L1		O2		R3		D4		E5	
	Nº	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	**%**	**Nº**	**%**
S. dashwoodia	351	35	288	28,8	531	62	220	40	105	9
L. sericata	127	12	145	16	132	15	155	20	243	36
C. albiceps	99	6	-	-	111	12	-	-	155	11
S. solterona	-	-	144	7	77	5	33	5	-	-
Others	234	16	379	41	244	17	179	32	486	57

species in every sample area, except for E5. Other significant species of the genus *Lucilia* and *Sarcophaga* were found.

Discussion

There is an increase in the number of species, genuses and families found in L1 and O2 sampling points, which is in accordance with previous data. Russian vegetation mass is known to be richer than that found in England and that could lead to a more diverse entomofauna [13,14]. Also, the data shows that corpses colonized mainly by *S. dashwoodia* match those where taxonomic richness is higher, a phenomenon previously studied [11,15,16].

As expected *S. dashwoodia* colonized most of the corpses studied, being the most abundant species in all of them. Although point E5 differs from this tendency, it's the only point where *S. dashwoodia* falls below 20%. Among the companion species the presence of *S. solterona*, *Chrysomya albiceps* and *Lucilia sericata* is remarkable. Many more species of genus *Chrysomya, Lucilia* and *Sarcophaga* popped as secondary species [15]. Some moth species belonging to genus *Tineola* and *Phereoeca* were found preying on *S. dashwoodia* larvae, among the species found *T. piruleta* and *P. chupachus* were the most abundants, which is in correlation with previous studies [16]. Cryptic species appeared in many of the corpses too, specially in those of L1 and O2 where the dipterans *Merodon petardus* and *Merodon flipendo* were almost indistinguible.

S. dashwoodia took between 1-3 days to arrive at each sampling point as previously reported [12,14]. After that, they completed its cycle in 2-3 weeks, being faster in those corpses that were put in more warm areas, such as R3, D5 and E6. Warm temperatures allow necrophagous insects to fasten their biological cycle and therefore they decompose infested corpses at a higher rate [9]. Thus, the examination of the faunal succession and the life stage of these insects could allow us to estimate the PMI with high accuracy.

The coverage value of *S. dashwoodia* was the highest in every studied area ranging from 30 to 60 %, with the exception of E6 where it dropped below 10%. This may be caused by the high presence of predatory moths like *T. piruleta* and *P. chupachus,* both prey on flesh-fly larvae and are likely to be the cause of the drastic reduction in the population of *S. dashwoodia* [10]. Despite this difference, the results obtained after estimating the PMI could not differ significantly from those of more populated corpses, which matches pre-existing research [11,14,16].

Conclusion

In view of the results obtained after carrying out this work we propose *S. dashwoodia* as a viable candidate for the estimation of PMI in real life scenarios where forensic entomology can supply valuable evidence. The fly was found at every sampling point as we previously predicted and that reinforces its utility as a possible PMI indicator.

More studies should be carried out in order to detail every phase of its living cycle. Research concerning the effect of temperature in the life cycle of this flesh-fly could be really useful too. Also, this pilot study should be amplified to cover different seasons, as by now it gives incomplete information.

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