

## Updated red lists of the grasshoppers and crickets (Orthoptera) in Flanders, Brussels and Wallonia

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### Abstract

Since the publication of the first red lists in 2000, the Belgian grasshopper and cricket fauna has changed considerably. As this group has now been studied quite intensively for about two decades, the detected trends have also become more reliable. Fortunately, most species did not decline since the nineties in Flanders, but *Stenobothrus lineatus* is still critically endangered. *Barbitistes serricauda* and *Stenobothrus stigmaticus* are endangered and *Ephippiger ephippiger* and *Tetrix tenuicornis* are vulnerable. Therefore, those species need conservation measures in order to maintain the current populations and, preferably, to extend their distribution area. On the other hand, four new species were discovered in Flanders: *Barbitistes serricauda*, *Meconema meridionale*, *Metrioptera bicolor* and *Oecanthus pellucens*. In Brussels, where intensive monitoring has been performed in the framework of the SaltaBru project, *Barbitistes serricauda* and *Stethophyma grossum* are critically endangered, *Tetrix tenuicornis* is endangered and *Gryllotalpa gryllotalpa* is vulnerable. Also in Brussels, four new species were detected: *Chorthippus albomarginatus*, *Conocephalus discolor*, *Meconema meridionale* and *Tetrix ceperoi*. In addition, *Barbitistes serricauda* could be confirmed. In Wallonia, *Decticus verrucivorus*, *Gryllotalpa gryllotalpa* and *Chorthippus mollis* are endangered, while *Euthystira brachyptera*, *Stenobothrus stigmaticus* and *Tetrix bipunctata* are vulnerable. *Ruspolia nitidula*, one of the species showing a northward expansion, has recently been discovered in Wallonia, however, no populations have been found so far.

**Keywords:** conservation; IUCN red list criteria; climate change; recording; threatened species.

### Samenvatting

Sinds de publicatie van de eerste rode lijst in 2000 is de Belgische fauna van sprinkhanen en krekels grondig gewijzigd. Omdat deze groep nu gedurende twee decennia vrij intensief werd bestudeerd, konden tevens meer betrouwbare trends worden bepaald. Gelukkig gingen de meeste soorten in Vlaanderen niet verder achteruit sinds de jaren negentig, maar *Stenobothrus lineatus* is nog steeds ernstig bedreigd. *Barbitistes serricauda* en *Stenobothrus stigmaticus* zijn bedreigd en *Ephippiger ephippiger* en *Tetrix tenuicornis* zijn kwetsbaar. Daarom hebben deze soorten beschermende maatregelen nodig om de huidige populaties te behouden en zo mogelijk hun areaal uit te breiden. Anderzijds werden vier nieuwe soorten waargenomen in Vlaanderen: *Barbitistes serricauda*, *Meconema meridionale*, *Metrioptera bicolor* en *Oecanthus pellucens*. In Brussel, waar een intensieve monitoring plaatsvond in het kader van het SaltaBru project, zijn *Barbitistes serricauda* en *Stethophyma grossum* ernstig bedreigd, *Tetrix tenuicornis* is bedreigd en *Gryllotalpa gryllotalpa* is kwetsbaar. Ook in Brussel werden vier nieuwe soorten gevonden: *Chorthippus albomarginatus*, *Conocephalus discolor*, *Meconema meridionale* en *Tetrix ceperoi*. Daarnaast kon het voorkomen van *Barbitistes serricauda* worden bevestigd. In Wallonië zijn *Decticus verrucivorus*, *Gryllotalpa gryllotalpa* en *Chorthippus mollis* bedreigd, terwijl *Euthystira brachyptera*, *Stenobothrus stigmaticus* en *Tetrix bipunctata* kwetsbaar zijn. *Ruspolia nitidula* is één van de soorten die noordwaarts uitbreidt en die recent werd ontdekt in Wallonië, maar tot nu toe werden nog geen populaties gevonden.

## Résumé

Depuis la publication du premier atlas en 2000, la faune belge des sauterelles et criquets a considérablement changé. Etant donné que ce groupe a été étudié de manière relativement intensive depuis deux décennies, on est maintenant en mesure d'estimer les tendances faunistiques avec plus de précision. Heureusement, la plupart des espèces en Flandre ne sont pas en déclin depuis les années quatre-vingt-dix, mais *Stenobothrus lineatus* est encore en danger critique. *Barbitistes serricauda* et *Stenobothrus stigmaticus* sont en danger et *Ephippiger ephippiger* et *Tetrix tenuicornis* sont vulnérables. Des mesures sont nécessaires pour protéger les populations encore présentes et, si possible, agrandir leur aire de distribution. D'autre part, quatre espèces autrefois absentes en Flandre ont été observées: *Barbitistes serricauda*, *Meconema meridionale*, *Metrioptera bicolor* et *Oecanthus pellucens*. A Bruxelles, où une campagne d'inventaire intensive a eu lieu dans le cadre du projet SaltaBru, *Barbitistes serricauda* et *Stethophyma grossum* sont en danger critique, *Tetrix tenuicornis* est en danger et *Gryllotalpa gryllotalpa* est vulnérable. Quatre espèces nouvelles ont également été signalées depuis le précédent atlas à Bruxelles: *Chorthippus albomarginatus*, *Conocephalus discolor*, *Meconema meridionale* et *Tetrix ceperoi* et la présence de *Barbitistes serricauda* a pu être confirmée. En Wallonie, *Decticus verrucivorus*, *Gryllotalpa gryllotalpa* et *Chorthippus mollis* sont en danger et *Euthystira brachyptera*, *Stenobothrus stigmaticus* et *Tetrix bipunctata* sont vulnérables. *Ruspolia nitidula* est une espèce dont l'aire de distribution est en forte expansion vers le nord et quelques individus ont récemment été observés en Wallonie, mais aucune population n'a encore été découverte.

## Introduction

Grasshoppers and crickets are an abundant group of insects and their diversity, functional significance, sensitivity to disturbances and ease of sampling make them useful indicators for land management (ANDERSEN *et al.*, 2001). As a consequence, their importance is now widely recognised and they are used in conservation and management planning (MAES *et al.*, 2006), species protection policy, local species action plans and environmental impact assessment.

Red lists are used to determine priorities for setting up species protection programmes or the delimitation of nature conservation areas or nature reserves. Red lists are also used to report on the state of the environment and to increase the awareness of the public. In Belgium, nature conservation policy is the responsibility of the regional governments (Flemish, Brussels and Walloon) and it is therefore appropriate to compile red lists per region rather than for Belgium as a whole. Since red lists are based on data that are subject to change, they should be revised regularly, for example every 10 years (IUCN, 2003). Since the appearance of the first red lists of grasshoppers and crickets (DECLÉER *et al.*, 2000), there have been considerable changes in environmental conditions caused by for example habitat loss, eutrophication, fragmentation, succession, altered nature management practices and global warming. Due to the high number of recent observations,

changes in the distribution of a lot of species became apparent. In addition, high numbers of records are now available for the last two decades, which allows to determine changes in distribution range more accurately. Finally, the previous red lists are now more than 10 years old. Moreover, since none of the Belgian species occur on the annexes of the Habitats Directive (94/43/EEG), good regional red lists are an essential part in grasshopper and cricket conservation. All these reasons warrant the publication of updated red lists for grasshoppers and crickets in Flanders, Brussels Capital Region (further abbreviated as Brussels) and Wallonia.

## Materials & methods

Since 1994, the World Conservation Union promotes the use of quantitative and objective criteria for the development of red lists (IUCN, 1994). The categories used here are the same as those proposed by the IUCN (2001). More recently, guidelines were developed for the application of red list criteria at the regional level (IUCN, 2003). As suggested by MAES *et al.* (2011a), the IUCN (2003) criteria were followed here. The status of the grasshoppers and crickets in Flanders, Brussels and Wallonia was determined based on a trend criterion as well as a rarity criterion.

The trend criterion, which reflects the change in the extent of the distribution range between

Table 1. Applied IUCN (2003) criteria for assignment of the current species status based on: (A2c) the historical trend based on the change in the relative number of 5x5km squares; none of the remaining assessed species declined by more than 20% since the nineties and the recent trend was therefore not used to assign species status and (B2) the rarity (number of locations was based on the number of 1x1km squares in Brussels and on the number of 5x5km squares in the other regions).

IUCN (2003) criterion	Critically endangered	Endangered	Vulnerable	Near threatened
A2c: reduction in the area of occupancy	=80%	=50%	=30%	=20%
B2: area of occupancy and at least both:	<10km <sup>2</sup>	<500km <sup>2</sup>	<2000km <sup>2</sup>	<3000km <sup>2</sup>
a. Fragmented or known from limited # locations	1	=5	=10	=15
b. Continuing decline in any of the following:				
(i) Extent of occurrence				
(ii) Area of occupancy				
(iii) Area, extent and/or quality of the habitat				
(iv) Number of locations or subpopulation				

two compared periods, is very important to determine the current status of a species. To determine the trend, short-term as well as long-term changes in distribution were taken into account as suggested by DE KNIJF (2006). It is important to know the historical decline, while especially recent changes need to be evaluated to judge nature management. The used double trend criterion allows to assess whether the decline of a certain species is still continuing, has been stabilised or whether a species is recovering or has started to decline recently. Because exact locations are often unknown, especially so for older records, presences in 5x5km UTM squares were used to evaluate trends. By dividing the number of squares where a species has been found by the number of all investigated squares in the same period, a correction was made for investigation effort. When the relative number of squares where a certain species was observed from 2000-2010 declined by more than 20% in comparison with either the period 1991-1999 to assess the recent trend or the period before 1991 to assess the historical trend, a species was considered as threatened. The latter two periods were the same as those evaluated for the previous red lists (DECLER *et al.*, 2000). The assignment of the current status of a species was based on the recent as well as the historical trend according to the IUCN (2003) criterion A2c mentioned in Table 1. A list of the scientific, Dutch and French names of the species occurring in Belgium is given in Table 2. The number of 5x5km squares where species were observed in each region and each period is indicated in Table 3 and the calculated trend is indicated in Table 4.

The working group Saltabel, which was

founded in 1989, launched a field survey on grasshoppers and crickets in Belgium and the rest of the Benelux, involving volunteers, amateur entomologists, naturalists and others. Observers mainly searched visually and auditively for Orthoptera in a variety of habitats. A few recorders also used a bat-detector, which is useful for species such as *Barbitistes serricauda* and *Leptophyes punctatissima* that cannot be heard otherwise, but also facilitates the observation of several other species, especially for people that have difficulties in hearing high tones. Several user-friendly field determination keys for grasshoppers became available in the course of the project (KLEUKERS, 2004; KLEUKERS & KREKELS, 2004). The working group maintains a database of observations, literature and collection data from 1800 onwards. A preliminary atlas including red lists was published in 2000 (DECLER *et al.*, 2000). At present, the Saltabel database contains about 44000 grasshopper occurrences, of which about one fifth came from museum collections or literature data. The database largely consists of incidental observations. Nevertheless, some observations originated from methodical sampling campaigns involving pitfall trapping and sweepnetting. Dubious records were checked by one of the authors and analyses were performed on validated occurrences only. Records minimally consisted of a species name, an observation date and a location. Locations were attributed to 1x1km or 5x5km grid cells of the UTM (Universal Transverse Mercator) grid. A large part of the Belgian territory has now been surveyed for grasshoppers as the database contains records of more than 90% of all 5x5km grid cells in Belgium (N=1376). More recently,

Table 2. Scientific and vernacular names (Dutch and French) of the species considered for evaluation.

SCIENTIFIC NAME	DUTCH NAME	FRENCH NAME
<i>Phaneroptera falcata</i> (PODA, 1761)	Sikkelsprinkhaan	Le Phanéroptère commun
<i>Barbitistes serricauda</i> (FABRICIUS, 1798)	Zaagsprinkhaan	Le Barbitiste des bois
<i>Leptophyes punctatissima</i> (BOSC, 1792)	Struiksprinkhaan	La Sauterelle ponctuée
<i>Meconema thalassinum</i> (DEGEER, 1773)	Boomsprinkhaan	La Sauterelle des chênes
<i>Meconema meridionale</i> COSTA, 1860	Zuidelijke boomsprinkhaan	Le Méconème fragile
<i>Conocephalus dorsalis</i> (LATREILLE, 1804)	Gewoon spitskopje	Le Conocéphale des roseaux
<i>Conocephalus discolor</i> (THUNBERG, 1815)	Zuidelijk spitskopje	Le Conocéphale bigarré
<i>Ruspolia nitidula</i> (SCOPOLI, 1786)	Grote spitskop	Le Conocéphale gracieux
<i>Tettigonia viridissima</i> (LINNAEUS, 1758)	Grote groene sabelsprinkhaan	La Grande sauterelle verte
<i>Tettigonia cantans</i> (FUESSLY, 1775)	Kleine groene sabelsprinkhaan	La Sauterelle cymbalière
<i>Decticus verrucivorus</i> (LINNAEUS, 1758)	Wrattenbijter	Le Dectique verrucivore
<i>Gampsocleis glabra</i> (HERBST, 1786)	Kleine wrattenbijter	Le Dectique des brandes
<i>Platycleis albopunctata</i> (GOEZE, 1778)	Duinsabelsprinkhaan	La Decticelle chagrinée
<i>Platycleis tessellata</i> (CHARPENTIER, 1825)	Dobbelsteensprinkhaan	La Decticelle carroyée
<i>Metrioptera brachyptera</i> (LINNAEUS, 1761)	Heidesabelsprinkhaan	La Decticelle des bruyères
<i>Metrioptera bicolor</i> (PHILIPPI, 1830)	Lichtgroene sabelsprinkhaan	La Decticelle bicolor
<i>Metrioptera roeselii</i> (HAGENBACH, 1822)	Greppelsprinkhaan	La Decticelle bariolée
<i>Pholidoptera griseoptera</i> (DEGEER, 1773)	Bramensprinkhaan	La Decticelle cendrée
<i>Ephippiger ephippiger</i> SERVILLE, 1831	Zadelsprinkhaan	L'Ephippigère des vignes
<i>Gryllus campestris</i> LINNAEUS, 1758	Veldkrekkel	Le Grillon des champs
<i>Gryllus bimaculatus</i> DEGEER, 1773	Zuidelijke veldkrekkel	Le Grillon provincial
<i>Acheta domestica</i> (LINNAEUS, 1758)	Huiskrekkel	Le Grillon domestique
<i>Gryllomorpha dalmatina</i> (OCSKAY, 1832)	Stomme krekkel	Le Grillon des bastides
<i>Nemobius sylvestris</i> (BOSC, 1792)	Boskrekkel	Le Grillon des bois
<i>Oecanthus pellucens</i> (SCOPOLI, 1763)	Boomkrekkel	Le Grillon d'Italie
<i>Gryllotalpa gryllotalpa</i> (LINNAEUS, 1758)	Veenmol	La Courtilière commune
<i>Tachycines asynamorus</i> ADELUNG, 1902	Kassprinkhaan	Le Sauterelle des serres
<i>Tetrix subulata</i> (LINNAEUS, 1758)	Zeggedoortje	Le Tétrix subulé
<i>Tetrix ceperoi</i> (BOLIVAR, 1887)	Zanddoortje	Le Tétrix des vasières
<i>Tetrix undulata</i> (SOWERBY, 1806)	Gewoon doortje	Le Tétrix des clairières
<i>Tetrix bipunctata</i> (LINNAEUS, 1758)	Bosdoortje	Le Tétrix calcicole
<i>Tetrix tenuicornis</i> SAHLBERG, 1893	Kalkdoortje	Le Tétrix des carrières
<i>Calliptamus italicus</i> (LINNAEUS, 1758)	Rosevleugel	Le Criquet italien
<i>Anacridium aegyptium</i> (LINNAEUS, 1764)	Egyptische sprinkhaan	Le Criquet égyptien
<i>Psophus stridulus</i> (LINNAEUS, 1758)	Klappersprinkhaan	Le Criquet stridulant
<i>Locusta migratoria</i> (LINNAEUS, 1758)	Europese treksprinkhaan	Le Criquet migrateur
<i>Oedipoda caerulea</i> (LINNAEUS, 1758)	Blauwvleugelsprinkhaan	L'Oedipode bleue
<i>Oedipoda germanica</i> (LATREILLE, 1804)	Roodvleugelsprinkhaan	L'Oedipode rouge
<i>Sphingonotus caeruleus</i> (LINNAEUS, 1767)	Kiezelsprinkhaan	L'Oedipode azurée
<i>Stethophyma grossum</i> (LINNAEUS, 1758)	Moerassprinkhaan	Le Criquet ensanglanté
<i>Chrysochraon dispar</i> (GERMAR, 1835)	Gouden sprinkhaan	Le Criquet des clairières
<i>Euthystira brachyptera</i> (OCSKAY, 1826)	Kleine goudsprinkhaan	Le Criquet des genévriers
<i>Stenobothrus lineatus</i> (PANZER, 1796)	Zoemertje	Le Criquet ligné
<i>Stenobothrus stigmaticus</i> (RAMBUR, 1839)	Schavertje	Le Sténobothre nain
<i>Omocestus viridulus</i> (LINNAEUS, 1758)	Wekkertje	Le Criquet verdelet
<i>Omocestus rufipes</i> (ZETTERSTEDT, 1821)	Negertje	Le Criquet noir-ébène
<i>Chorthippus vagans</i> (EVERSMANN, 1848)	Steppesprinkhaan	Le Criquet des pins
<i>Chorthippus brunneus</i> (THUNBERG, 1815)	Bruine sprinkhaan	Le Criquet duettiste
<i>Chorthippus biguttulus</i> (LINNAEUS, 1758)	Ratelaar	Le Criquet mélodieux
<i>Chorthippus mollis</i> (CHARPENTIER, 1825)	Snortikker	Le Criquet des jachères
<i>Chorthippus albomarginatus</i> (DEGEER, 1773)	Kustsprinkhaan	Le Criquet marginé
<i>Chorthippus dorsatus</i> (ZETTERSTEDT, 1821)	Weidesprinkhaan	Le Criquet verte-échine
<i>Chorthippus parallelus</i> (ZETTERSTEDT, 1821)	Krasser	Le Criquet des pâtures
<i>Chorthippus montanus</i> (CHARPENTIER, 1825)	Zompsprinkhaan	Le Criquet palustre
<i>Myrmeleotettix maculatus</i> (THUNBERG, 1815)	Knopsrietje	Le Gomphocère tacheté
<i>Gomphocerippus rufus</i> (LINNAEUS, 1758)	Rosse sprinkhaan	Le Gomphocère roux

Table 3. Number of 5x5km squares (with for Brussels also the number of 1x1km squares after 1999 between brackets) where species occurred in the three considered periods in Flanders, Brussels and Wallonia.

	FLANDERS			BRUSSELS			WALLONIA		
	<1991	1991-1999	>1999	<1991	1991-1999	>1999	<1991	1991-1999	>1999
<i>Acheta domesticus</i>	22	44	60	7		1 (1)	68	22	15
<i>Anacridium aegyptium</i>		1					1		1
<i>Barbitistes serricauda</i>			2	1		1 (1)	8	10	57
<i>Calliptamus italicus</i>							1		2
<i>Chorthippus</i>	17	37	79			1 (1)	9	33	29
<i>Chorthippus biguttulus</i>	96	177	234	5	3	11	115	160	164
<i>Chorthippus brunneus</i>	96	178	222	7	6	12	159	205	215
<i>Chorthippus dorsatus</i>							1	3	14
<i>Chorthippus mollis</i>	30	55	79					4	4
<i>Chorthippus montanus</i>	20	24	33	1			10	9	11
<i>Chorthippus parallelus</i>	168	280	329	7	5	13	360	313	366
<i>Chorthippus vagans</i>							14	10	18
<i>Chrysochraon dispar</i>	12	23	62				96	164	207
<i>Conocephalus discolor</i>	4	52	192			11	8	77	134
<i>Conocephalus dorsalis</i>	106	155	183	4	5	10	23	49	80
<i>Decticus verrucivorus</i>	11			1			18	2	5
<i>Ephippiger ephippiger</i>	6	10	10						
<i>Euthystira brachyptera</i>							4	3	8
<i>Gampsocleis glabra</i>	2								
<i>Gomphocerippus rufus</i>	1	1	4				27	36	66
<i>Grylломорpha dalmatina</i>				1			1		
<i>Gryllotalpa gryllotalpa</i>	28	24	57	4		5 (7)	18	3	7
<i>Gryllus bimaculatus</i>	1	1							
<i>Gryllus campestris</i>	29	52	70	5			25	20	24
<i>Leptophyes punctatissima</i>	23	84	131	4	2	12	143	109	186
<i>Locusta migratoria</i>	10						5		
<i>Meconema meridionale</i>			25			9 (40)		1	18
<i>Meconema thalassinum</i>	53	84	100	7	4	11	140	101	149
<i>Metrioptera bicolor</i>			2				36	64	75
<i>Metrioptera brachyptera</i>	31	47	61				33	31	39
<i>Metrioptera roeselii</i>	17	27	68				6	25	46
<i>Myrmeleotettix maculatus</i>	65	93	116				58	69	62
<i>Nemobius sylvestris</i>	10	31	52				74	72	103
<i>Oecanthus pellucens</i>			8	1			1	5	28
<i>Oedipoda caerulescens</i>	32	36	67		1	5 (14)	59	47	101
<i>Oedipoda germanica</i>							1		1
<i>Omocestus rufipes</i>	23	51	57				65	44	49
<i>Omocestus viridulus</i>	14	32	40	1			113	118	107
<i>Phaneroptera falcata</i>		22	132		2	9 (34)	4	36	64
<i>Pholidoptera griseoaptera</i>	47	143	151	7	7	12	243	228	268
<i>Platycleis albopunctata</i>	17	9	18				18	15	26
<i>Platycleis tessellata</i>							1		
<i>Psophus stridulus</i>	2								
<i>Ruspolia nitidula</i>									1
<i>Sphingonotus caeruleans</i>								2	8
<i>Stenobothrus lineatus</i>	4	1	1				42	30	31
<i>Stenobothrus stigmaticus</i>	5	4	5				11	7	10
<i>Stethophyma grossum</i>	27	31	83	1		1 (1)	21	54	97
<i>Tachycines asynamorus</i>	1		1						
<i>Tetrix bipunctata</i>	1						11	11	10
<i>Tetrix ceperoi</i>	17	19	52			2 (2)	1		9
<i>Tetrix subulata</i>	54	88	139	7	5	11	108	69	112
<i>Tetrix tenuicornis</i>	3	8	10	6	1	4 (5)	47	21	60
<i>Tetrix undulata</i>	106	139	162	5	4	8 (13)	240	140	207
<i>Tettigonia cantans</i>							19	27	37
<i>Tettigonia viridissima</i>	121	232	259	8	7	12	230	211	279
Number of investigated	327	438	466	8	8	14	538	497	542

Table 4. Historical (<1991 versus >1999) and recent (1991-1999 versus >1999) trend (%) of the relative abundance (corrected for investigation effort) of grasshopper and cricket species in Flanders, Brussels, Wallonia and Belgium. Species that were not recorded in both periods are indicated as 'absent', those that are only present in the last period are indicated as 'new'.

	FLANDERS		BRUSSELS		WALLONIA		BELGIUM	
	Historical	Recent	Historical	Recent	Historical	Recent	Historical	Recent
<i>Acheta domesticus</i>	91	28	-92	absent	-78	-37	-33	6
<i>Anacridium aegyptium</i>	absent	-100			-1	absent	-15	-8
<i>Barbitistes serricauda</i>	new	new	-43	new	607	423	469	454
<i>Calliptamus italicus</i>					99	absent	71	absent
<i>Chorthippus</i>	226	101	new	new	220	-19	258	44
<i>Chorthippus biguttulus</i>	71	24	26	110	42	-6	62	11
<i>Chorthippus brunneus</i>	62	17	-2	14	34	-4	46	7
<i>Chorthippus dorsatus</i>					1290	328	1096	331
<i>Chorthippus mollis</i>	85	35			new	-8	136	30
<i>Chorthippus montanus</i>	16	29	-100	absent	9	12	21	23
<i>Chorthippus parallelus</i>	37	10	6	49	1	7	13	9
<i>Chorthippus vagans</i>					28	65	10	66
<i>Chrysochraon dispar</i>	263	153			114	16	113	33
<i>Conocephalus discolor</i>	3268	247	new	new	1563	60	2299	141
<i>Conocephalus dorsalis</i>	21	11	43	14	245	50	75	21
<i>Decticus verrucivorus</i>	-100	absent	-100	absent	-72	129	-86	131
<i>Ephippiger ephippiger</i>	17	-6					42	-8
<i>Euthystira brachyptera</i>					99	145	71	146
<i>Gampsocleis glabra</i>	-100	absent					-100	absent
<i>Gomphocerippus rufus</i>	181	276					114	75
<i>Gryllomorpha dalmatina</i>			-100	absent	-100	absent	-100	absent
<i>Gryllotalpa gryllotalpa</i>	43	123	-29	absent	-61	114	18	136
<i>Gryllus bimaculatus</i>	-100	-100					-100	-100
<i>Gryllus campestris</i>	69	27	-100	absent	-5	10	36	20
<i>Leptophyes punctatissima</i>	300	47	71	243	29	56	65	56
<i>Locusta migratoria</i>	-100	absent			-100	absent	-100	absent
<i>Meconema meridionale</i>	new	new	new	new	new	1551	n	4698
<i>Meconema thalassinum</i>	32	12	-10	57	6	35	11	27
<i>Metrioptera bicolor</i>	new	new			107	7	83	11
<i>Metrioptera brachyptera</i>	38	22			17	15	33	18
<i>Metrioptera roeselii</i>	181	137			661	69	323	102
<i>Myrmeleotettix maculatus</i>	25	17			6	-18	24	1
<i>Nemobius sylvestris</i>	265	58			38	31	58	39
<i>Oecanthus pellucens</i>	new	new	-100	absent	2679	414	1438	564
<i>Oedipoda caerulescens</i>	47	75	new	186	70	97	62	90
<i>Oedipoda germanica</i>					-1	absent	-15	absent
<i>Omocestus rufipes</i>	74	5			-25	2	3	3
<i>Omocestus viridulus</i>	100	17	-100	absent	-6	-17	-2	-10
<i>Phaneroptera falcata</i>	new	464	new	157	1488	63	4278	215
<i>Pholidoptera griseoaptera</i>	125	-1	-2	-2	9	8	24	5
<i>Platycleis albopunctata</i>	-26	88			43	59	7	69
<i>Platycleis tessellata</i>					-100	absent	-100	absent
<i>Psophus stridulus</i>	-100	absent					-100	absent
<i>Ruspolia nitidula</i>					new	new	new	new
<i>Sphingonotus caeruleans</i>					new	267	new	269
<i>Stenobothrus lineatus</i>	-82	-6			-27	-5	-41	-5
<i>Stenobothrus stigmaticus</i>	-30	17			-10	31	-20	26
<i>Stethophyma grossum</i>	116	152	-43	absent	358	65	216	96
<i>Tachycines asynamorus</i>	-30	absent					-15	absent
<i>Tetrix bipunctata</i>	-100	absent			-10	-17	-29	-16
<i>Tetrix ceperoi</i>	115	157	new	new	793	absent	199	206
<i>Tetrix subulata</i>	81	48	-10	26	3	49	32	49
<i>Tetrix tenuicornis</i>	134	17	-62	129	27	162	13	128
<i>Tetrix undulata</i>	7	10	-9	14	-14	36	-8	23
<i>Tettigonia cantans</i>					93	26	66	26
<i>Tettigonia viridissima</i>	50	5	-14	-2	20	21	31	13

Table 5. Current status of the grasshoppers and crickets (Orthoptera) of Flanders, Brussels, Wallonia and the whole country of Belgium, with indication of the fulfilled IUCN (2003) criterion.

FLANDERS	BRUSSELS	WALLONIA	BELGIUM
<b>Regionally extinct (5)</b>	<b>Regionally extinct (5)</b>	<b>Regionally extinct (1)</b>	<b>Regionally extinct (3)</b>
<i>Decticus verrucivorus</i>	<i>Chorthippus montanus</i>	<i>Locusta migratoria</i>	<i>Gampsocleis glabra</i>
<i>Gampsocleis glabra</i>	<i>Decticus verrucivorus</i>	<b>Endangered (3)</b>	<i>Locusta migratoria</i>
<i>Locusta migratoria</i>	<i>Gryllus campestris</i>	<i>Decticus verrucivorus</i> (A2c, B2)	<i>Psophus stridulus</i>
<i>Psophus stridulus</i>	<i>Oecanthus pellucens</i>	<i>Gryllotalpa gryllotalpa</i> (A2c)	<b>Critically endangered (1)</b>
<i>Tetrix bipunctata</i>	<i>Omocestus viridulus</i>	<i>Chorthippus mollis</i> (B2)	<i>Decticus verrucivorus</i> (A2c)
<b>Critically endangered (1)</b>	<b>Critically endangered (2)</b>	<b>Vulnerable (3)</b>	<b>Vulnerable (4)</b>
<i>Stenobothrus lineatus</i> (A2c,B2)	<i>Barbitistes serricauda</i> (B2)	<i>Euthystira brachyptera</i> (B2)	<i>Ephippiger ephippiger</i> (B2)
<b>Endangered (2)</b>	<i>Stethophyma grossum</i> (B2)	<i>Stenobothrus stigmaticus</i> (B2)	<i>Euthystira brachyptera</i> (B2)
<i>Barbitistes serricauda</i> (B2)	<b>Endangered (1)</b>	<i>Tetrix bipunctata</i> (B2)	<i>Stenobothrus lineatus</i> (A2c)
<i>Stenobothrus stigmaticus</i> (B2)	<i>Tetrix tenuicornis</i> (A2c, B2)	<b>Near threatened (2)</b>	<i>Tetrix bipunctata</i> (B2)
<b>Vulnerable (2)</b>	<b>Vulnerable (1)</b>	<i>Chorthippus montanus</i> (B2)	<b>Near threatened (1)</b>
<i>Ephippiger ephippiger</i> (B2)	<i>Gryllotalpa gryllotalpa</i> (B2)	<i>Omocestus rufipes</i> (A2c)	<i>Stenobothrus stigmaticus</i> (B2)
<i>Tetrix tenuicornis</i> (B2)	<b>Near threatened (2)</b>	<i>Stenobothrus lineatus</i> (A2c)	<b>Least concern (21)</b>
<b>Near threatened (1)</b>	<i>Oedipoda caerulea</i> (B2)	<b>Least concern (27)</b>	<i>Barbitistes serricauda</i>
<i>Platycleis albopunctata</i> (A2c)	<i>Tetrix undulata</i> (B2)	<i>Barbitistes serricauda</i>	<i>Chorthippus albomarginatus</i>
<b>Least concern (31)</b>	<b>Least concern (14)</b>	<i>Chorthippus albomarginatus</i>	<i>Chorthippus biguttulus</i>
<i>Chorthippus albomarginatus</i>	<i>Chorthippus albomarginatus</i>	<i>Chorthippus biguttulus</i>	<i>Chorthippus brunneus</i>
<i>Chorthippus biguttulus</i>	<i>Chorthippus biguttulus</i>	<i>Chorthippus brunneus</i>	<i>Chorthippus dorsatus</i>
<i>Chorthippus brunneus</i>	<i>Chorthippus brunneus</i>	<i>Chorthippus dorsatus</i>	<i>Chorthippus mollis</i>
<i>Chorthippus mollis</i>	<i>Chorthippus parallelus</i>	<i>Chorthippus parallelus</i>	<i>Chorthippus montanus</i>
<i>Chorthippus montanus</i>	<i>Conocephalus discolor</i>	<i>Chorthippus vagans</i>	<i>Chorthippus parallelus</i>
<i>Chorthippus parallelus</i>	<i>Conocephalus dorsalis</i>	<i>Chrysochraon dispar</i>	<i>Chorthippus vagans</i>
<i>Chrysochraon dispar</i>	<i>Leptophyes punctatissima</i>	<i>Conocephalus discolor</i>	<i>Chrysochraon dispar</i>
<i>Conocephalus discolor</i>	<i>Meconema meridionale</i>	<i>Conocephalus dorsalis</i>	<i>Conocephalus discolor</i>
<i>Conocephalus dorsalis</i>	<i>Meconema thalassinum</i>	<i>Gomphocerippus rufus</i>	<i>Conocephalus dorsalis</i>
<i>Gomphocerippus rufus</i>	<i>Phaneroptera falcata</i>	<i>Gryllus campestris</i>	<i>Gomphocerippus rufus</i>
<i>Gryllotalpa gryllotalpa</i>	<i>Pholidoptera griseoaptera</i>	<i>Leptophyes punctatissima</i>	<i>Gryllotalpa gryllotalpa</i>
<i>Gryllus campestris</i>	<i>Tetrix ceperoi</i>	<i>Meconema meridionale</i>	<i>Gryllus campestris</i>
<i>Leptophyes punctatissima</i>	<i>Tetrix subulata</i>	<i>Meconema thalassinum</i>	<i>Leptophyes punctatissima</i>
<i>Meconema meridionale</i>	<i>Tettigonia viridissima</i>	<i>Metrioptera bicolor</i>	<i>Meconema meridionale</i>
<i>Meconema thalassinum</i>	<b>Not applicable (2)</b>	<i>Metrioptera brachyptera</i>	<i>Meconema thalassinum</i>
<i>Metrioptera bicolor</i>	<i>Acheta domesticus</i>	<i>Metrioptera roeselii</i>	<i>Metrioptera bicolor</i>
<i>Metrioptera brachyptera</i>	<i>Gryllomorpha dalmatina</i>	<i>Myrmeleotettix maculatus</i>	<i>Metrioptera brachyptera</i>
<i>Metrioptera roeselii</i>		<i>Nemobius sylvestris</i>	<i>Metrioptera roeselii</i>
<i>Myrmeleotettix maculatus</i>		<i>Oecanthus pellucens</i>	<i>Myrmeleotettix maculatus</i>
<i>Nemobius sylvestris</i>		<i>Oedipoda caerulea</i>	<i>Nemobius sylvestris</i>
<i>Oecanthus pellucens</i>		<i>Omocestus viridulus</i>	<i>Oecanthus pellucens</i>
<i>Oedipoda caerulea</i>		<i>Phaneroptera falcata</i>	<i>Oedipoda caerulea</i>
<i>Omocestus rufipes</i>		<i>Pholidoptera griseoaptera</i>	<i>Omocestus rufipes</i>
<i>Omocestus viridulus</i>		<i>Platycleis albopunctata</i>	<i>Omocestus viridulus</i>
<i>Phaneroptera falcata</i>		<i>Sphingonotus caeruleus</i>	<i>Phaneroptera falcata</i>
<i>Pholidoptera griseoaptera</i>		<i>Stethophyma grossum</i>	<i>Pholidoptera griseoaptera</i>
<i>Stethophyma grossum</i>		<i>Tetrix ceperoi</i>	<i>Platycleis albopunctata</i>
<i>Tetrix ceperoi</i>		<i>Tetrix subulata</i>	<i>Sphingonotus caeruleus</i>
<i>Tetrix subulata</i>		<i>Tetrix tenuicornis</i>	<i>Stethophyma grossum</i>
<i>Tetrix undulata</i>		<i>Tetrix undulata</i>	<i>Tetrix ceperoi</i>
<i>Tettigonia viridissima</i>		<i>Tettigonia cantans</i>	<i>Tetrix subulata</i>
<b>Not applicable (4)</b>		<i>Tettigonia viridissima</i>	<i>Tetrix tenuicornis</i>
<i>Acheta domesticus</i>		<b>Not applicable (7)</b>	<i>Tetrix undulata</i>
<i>Anacridium aegyptium</i>		<i>Acheta domesticus</i>	<i>Tettigonia cantans</i>
<i>Gryllus bimaculatus</i>		<i>Anacridium aegyptium</i>	<i>Tettigonia viridissima</i>
<i>Tachycines asymorus</i>		<i>Calliptamus italicus</i>	<b>Not applicable (9)</b>
		<i>Gryllomorpha dalmatina</i>	<i>Acheta domesticus</i>
		<i>Oedipoda germanica</i>	<i>Anacridium aegyptium</i>
		<i>Platycleis tessellata</i>	<i>Calliptamus italicus</i>
		<i>Ruspolia nitidula</i>	<i>Gryllomorpha dalmatina</i>
			<i>Gryllus bimaculatus</i>
			<i>Oedipoda germanica</i>
			<i>Platycleis tessellata</i>
			<i>Ruspolia nitidula</i>
			<i>Tachycines asymorus</i>

online recording has become a popular tool and has greatly enhanced the level of detail of recordings. For a limited number of species, for which the Saltabel database was suspected to contain important gaps, online encoding tools were checked for additional occurrences.

The rarity was based on the area of occupancy (IUCN, 2003) and in addition, two criteria should be fulfilled: (1) there should be fragmentation or a limited number of locations where the species occurs and (2) there should be a continuing decline in the extent of occurrence, the area of occupancy, the area, extent and/or quality of the habitat or the number of locations of subpopulations (Table 1). Since fragmentation and the presence of a decline are relatively subjective, the red list category was mainly determined based on the number of locations where a species was found. The number of locations was quantified as the number of 5x5km squares (Flanders and Wallonia) or 1x1km squares (Brussels) where a species was observed in the period 2000-2010. In accordance with the new red list for butterflies (MAES *et al.*, 2011b), the extent of occurrence was not taken into account since it is not suitable for small regions: all species would be potentially vulnerable according to the IUCN (2003) criterion B1 because the extent of occurrence is always smaller than 20000km<sup>2</sup>, since the three regions under consideration cover a smaller area. Other criteria mentioned in the IUCN (2003) guideline are not considered relevant for grasshoppers, among others because no population sizes were determined and because no modelling efforts were performed.

Species for which no populations have been found in Belgium so far (*Calliptamus italicus*, *Oedipoda germanica*, *Platycleis tessellata* and *Ruspolia nitidula*) were considered vagrant and hence were categorised 'not applicable' according to IUCN (2003) guidelines. Also alien species (*Acheta domesticus*, *Anacridium aegyptium*, *Gryllomorpha dalmatina*, *Gryllus bimaculatus* and *Tachycines asynamorus*) were not assessed here and were equally categorised 'not applicable'.

## Results

Because nature policy in Belgium is a competence of the regions, regional red lists were developed for the grasshoppers and crickets (Orthoptera) in Flanders, Brussels and

Wallonia (Table 5). The most threatened and the rarest species from each region are discussed below.

### Flanders

*Decticus verrucivorus* (Fig. 1), *Gampsocleis glabra*, *Locusta migratoria*, *Psophus stridulus* and *Tetrix bipunctata* are considered as regionally extinct in Flanders. Also *Stenobothrus lineatus* (Fig. 2) is on the verge of extinction. The species prefers dry grasslands with a short vegetation and its distribution was restricted to a few heathlands in Limburg containing patches with short vegetation. Due to a lack of management, succession caused the further closure of the vegetation, which led to a disastrous decline in suitable habitat. The increasing number of restoration efforts in heathlands hopefully does not come too late for this critically endangered species, which has only been observed at one location during the last decade.

*Barbitistes serricauda* was recently discovered in Flanders (VERCRUYSSSE & DE RYCKE, 2008). This cryptic species inhabits south-exposed forests and forest edges. As the species lives high in trees, the best way to find it is by using a bat-detector (LEE, 2004). The species might also occur in other forests. However, as extensive forests are rare in Flanders, this species undoubtedly has a limited distribution area. As this species was probably overlooked in the past and because it has only been found in two localities, *B. serricauda* is currently considered as endangered in Flanders. *Stenobothrus stigmaticus* lives on grasslands with a short vegetation. The remaining populations are very small and the distribution is extremely fragmented. The species is therefore endangered. Since conservation measures could help this species, it might be a good idea to develop a species action plan for *S. stigmaticus*.

*Ephippiger ephippiger* is a vulnerable species in Flanders, which lives on dry, warm heathlands with scattered bushes. It has always been restricted to the surroundings of the recently developed national park 'Hoge Kempen' (LAMBRECHTS *et al.*, 2006). The species will probably benefit from the national park status due to the increased management effort in the area. However, classic purple heathland management (uniform and relatively frequent mowing regimes) should be avoided as





Fig. 1. *Decticus verrucivorus* became extinct in Flanders and Brussels and is endangered in Wallonia.



Fig. 2. *Stenobothrus lineatus* is critically endangered in Flanders and is near threatened in Wallonia.



Fig. 3. *Meconema meridionale*, one of the southern species that recently extended its distribution area northward.

the species prefers older heathlands with some shrubs or large heather plants present (VAN DELFT *et al.*, 2000; EYKENS, 2008). As the species is unable to fly, it is not very mobile. Management efforts should therefore give priority to restoring connectivity between habitat patches. Alternatively, introductions, covered by a species protection plan or approved management plans, could be explored

as a method to extend the distribution range when suitable habitat becomes available in other areas. Meanwhile, a local action plan for *E. ephippiger* has been set up in the municipality Dilsen-Stokkem (Limburg) (BAERT, 2007a). *Tetrix tenuicornis*, which only occurs in sparsely vegetated areas on calcareous soils such as gravelbanks along the river Meuse and calcareous grasslands, is also vulnerable. The latter species could benefit from the restructuring of the border Meuse due to the nature restoration project 'Levende Grensmaas'.

All inland populations of *Platycleis albopunctata* in Flanders went extinct and this species is near threatened in Flanders. The species remains fairly common in the remaining coastal dunes, where it appears to benefit from nature management and restoration measures (PROVOOST *et al.*, 2010). Regaining this species in the Campine area will only be possible when larger areas with living land dunes are restored before a reintroduction can be considered.

Three additional species are rare in Flanders, however, these species are expanding and the used IUCN (2003) criteria (Table 1) are not fulfilled since no decline is detected. *Gomphocerippus rufus* prefers warm biotopes with a relatively dense and sufficiently high grass cover or brushwood vegetation, especially along forest edges. The species seems to extend its distribution range (DECLEER *et al.*, 2002; LAMBRECHTS, 2006) and might become more abundant in Flanders in the future. *Metrioptera bicolor* has recently colonised Flanders: at one location a single macropterous male was observed and at another six singing brachypterous males were observed (JACOBS *et al.*, 2005). The latter record indicated that the population probably established at least one year before the observation and therefore this species was not considered as an incidental vagrant. *M. bicolor* reaches its northernmost distribution edge in Flanders, but due to global warming, it will probably become more common in the future. Also *Oecanthus pellucens* could profit from increased temperatures: it recently colonised Flanders and is currently extending its distribution range.

Although *O. viridulus* and *Nemobius sylvestris* are not considered as threatened on a Flemish scale, they are subject to a local action plan in the municipalities Houthalen-Helchteren and Meeuwen-Gruitrode, respectively (both in Limburg) (BAERT, 2007b,c).

## Brussels

During the SaltaBru project, the grasshoppers in Brussels were inventoried on a 1x1km scale with a very high sampling effort (SAN MARTIN *et al.*, 2006). As a consequence, the current distribution of grasshoppers in Brussels is well documented. However, the historical data are characterised by a much lower spatial precision (5x5km) and the comparison between the two periods is rather difficult as is the correction for sampling effort. The use of 5x5km is also particularly badly adapted to such a small territory (160 km<sup>2</sup>). It should also be noted that the IUCN regional guidelines strongly discourage application of the guidelines within very restricted geographical areas. Depending on the presence of dispersal barriers, a higher turn-over of species in smaller regions, assessments of extinction risk may become increasingly unreliable (IUCN, 2003). Despite this and because nature policy is a regional competence, we evaluated rarity on the basis of the relative number of 1x1km squares in Brussels and assessed trends based on 5x5km squares due to the lack of an alternative.

*Chorthippus montanus*, *Decticus verrucivorus* (Fig. 1), *Gryllus campestris*, *Oecanthus pellucens* and *Omocestus viridulus* are considered regionally extinct in Brussels. The occurrence of *Barbitistes serricauda* was recently confirmed in the Sonian Forest. Currently, only one small population is known of this critically endangered species. Nevertheless, the presence of other populations of this secluded forest species might be suspected. *Stethophyma grossum* was formerly considered as regionally extinct (DECLEER *et al.*, 2000), but recently a few individuals were observed in the humid grassland of the 'Hof ter Muschen' nature reserve. The extreme isolation and the small size of the population increase the probability of extinction from the region and therefore, also this species is considered as critically endangered.

*Tetrix tenuicornis* is considered as endangered. This xerothermophilous species is in Brussels strictly associated with sparse ruderal vegetation occurring along railways. *Gryllotalpa gryllotalpa* lives underground in peaty soils and is restricted to a few vegetable gardens in the capital region and the species is considered vulnerable.

*Oedipoda caerulescens* is strongly associated

with railways in Brussels and most populations are small and living on sites threatened by intensive herbicide use. *Tetrix undulata* lives on sparsely vegetated soils. Both species are near threatened in Brussels.

During the Saltabru project, four species were observed for the first time in Brussels: *Chorthippus albomarginatus*, *Tetrix ceperoi*, *Meconema meridionale* (Fig. 3) and *Conocephalus discolor*. Meanwhile, the latter two species have become quite common, while the former two are still extremely localised. A small population of *C. albomarginatus* was recently discovered in Brussels in an abandoned garden, however, it is not yet clear if this species will settle in Brussels. There is only one known population of *Tetrix ceperoi* in Brussels on the Tour & Taxis site. This species prefers sunny places on sparsely vegetated soils, which are fairly scarce in Brussels. The ongoing building projects on the site compromises the survival of this population. However, since *C. albomarginatus* and *T. ceperoi* do not fulfil the IUCN (2003) criteria, they are not considered as threatened.

## Wallonia

*Locusta migratoria* is considered regionally extinct in Wallonia. *Decticus verrucivorus* (Fig. 1) was also considered to be regionally extinct in the Walloon region (DECLEER *et al.*, 2000), until the species was rediscovered (LOCK, 2002). It occurs on dry calcareous grasslands and heathlands with a great variation in vegetation structure, with open spaces as well as dense vegetation patches. Currently, this endangered species is restricted to the military domains of Lagland (Arlon) and Elsenborn and their surroundings. Appropriate management should ascertain that the remaining habitats of this critically endangered species are safeguarded from forest succession. The distribution area could be enlarged if appropriate management strategies were applied after the removal of coniferous forest plantations. *Gryllotalpa gryllotalpa* lives underground in humid, peaty soils. Due to the low number of recent observations, the species is reported as endangered. Nevertheless, the species is difficult to monitor and, as it is known to inflict damage in vegetable gardens, inquiries with gardeners or farmers could improve the knowledge about its current distribution.

*Chorthippus mollis* has only been found on a few dry heathlands and acidic grasslands and is therefore also considered endangered.

*Euthystira brachyptera* is a vulnerable species that can only be found on a few heathlands and calcareous grasslands in the Lorraine area. *Stenobothrus stigmaticus* lives on grasslands with a short vegetation and is also vulnerable. Although two larger populations are still present in Wallonia, most populations are extremely small and fragmented (GRAITSON *et al.*, 2005). *Tetrix bipunctata* lives in dry, warm places with a sparse vegetation such as calcareous grasslands with rocky soil or in quarries, usually in close vicinity of forest. This vulnerable species only occurs at a few locations in the Calestienne area, where the subspecies *T. bipunctata bipunctata* occurs, and the Lorraine area, where the subspecies *T. bipunctata kraussi* occurs.

*Stenobothrus lineatus* (Fig. 2) prefers thermophilous grasslands with a short vegetation, especially calcareous grasslands. *Omocestus rufipes* can often be found in the same locations, but also in dry heathlands. The dramatic historic decline and fragmentation of calcareous grasslands (ADRIAENS *et al.*, 2006) and the vegetational succession on the remaining fragments following a lack of management have resulted in the decline of both species, which are considered near threatened. Recently, calcareous grassland, especially in the Calestienne area, are receiving more attention, but a lot of work remains in order to restore their historical coverage. Also *Chorthippus montanus*, which prefers humid grasslands on peaty soil, is considered near threatened.

Besides the threatened species mentioned above, several species are also rare in Wallonia but do not fulfil the IUCN (2003) criteria since there is no decline detectable. *Chorthippus dorsatus* occurs only in grasslands in the Lorraine area. *Sphingonotus caeruleus*, which reached Wallonia in 1998 (DECLÉER *et al.*, 2000), is still expanding its distribution range, however, this species still remains extremely localised in Wallonia. *Tetrix ceperoi* has recently been rediscovered on several sparsely vegetated locations in Wallonia (GRAITSON *et al.*, 2005), but it remains unclear whether the species is expanding its distribution range or whether it has simply been overlooked in the past.

In 2009, two specimens of *Ruspolia nitidula*

were discovered in the Viroin area (Hofmans, unpublished data). In line with its ongoing European expansion, it is expected that this species will colonise and establish in Belgium in the near future.

### Belgium

Although nature conservation is a regional matter in Belgium, a red list was also developed for the whole country using the same criteria (Table 5). Such a national list can be used for comparisons between countries. *Gampsocleis glabra*, *Locusta migratoria* and *Psophus stridulus* are regionally extinct in Belgium, *Decticus verrucivorus* (Fig. 1) is critically endangered, *Ephippiger ephippiger*, *Euthystira brachyptera*, *Stenobothrus lineatus* (Fig. 2) and *Tetrix bipunctata* are vulnerable and *Stenobothrus stigmaticus* is near threatened.

### Discussion

The relative number of 5x5km squares where grasshoppers and crickets occurred did not decrease for any species by more than 20% in Flanders, Brussels and Wallonia since the nineties. This might indicate that current conservation practices have halted the decline of grasshopper and cricket species in Belgium. Nonetheless, a lot of species remain rare and require additional conservation measures in order to maintain the current populations or, preferable, to extend their distribution area.

It should be noted that working with 5x5km squares is too crude to quantitatively detect changes in the number of populations or the population size of a species (IUCN (2003) criteria A, C and D). Because a species was considered present in a square as soon as one specimen was observed, a decline could only be observed when a species was not longer observed in those squares. In addition, a correction was made for investigation effort by taking the number of investigated squares into account. However, an increased number of visits per square could have increased the probability of detecting a species. It is therefore possible that the decline of certain species remained unnoticed.

Although juridically the red list status of a species is a prerequisite for setting up a species protection plan in Flanders (Flemish Government Decision of 15/05/2009 on species

protection and species management), setting conservation priorities should also take other factors (ecological, functional and pragmatic) into account besides a snapshot of the relative estimate of the likelihood of extinction (IUCN, 2001, 2003). Although endangered and vulnerable species deserve priority, also near threatened or locally threatened or rare species should receive appropriate attention. In Flanders, *Oedipoda caerulescens*, *Stenobothrus lineatus* (Fig. 2), *Tettigonia viridissima* and *Gomphocerippus rufus* have received (basic) juridical protection (Flemish Government Decision of 15/05/2009 on species protection and species management). Of these, *S. lineatus* is critically endangered, while *G. rufus*, *T. viridissima* and *O. caerulescens* are considered of least concern. Therefore, we argue that the current arsenal of legislation is not targeted and insufficient for Orthoptera protection. Moreover, a time lag in a species response to historic habitat destruction or fragmentation might result in an extinction debt, with species still occupying habitat fragments in which they will ultimately disappear (TILMAN *et al.*, 1994). As a result, the current area of occupancy may overestimate the carrying capacity of the present landscape. This might very well be the case for some threatened species in Belgium (i.e. *Stenobothrus stigmaticus*), for which no decrease in the number of populations could be detected yet, but of which the populations are extremely small and fragmented. This might also be true for some species of which the habitat suffered a dramatic historic decline such as calcareous grasslands or dunes. Species recovery plans should therefore take a holistic approach, taking into account both habitat suitability and spatial structure of the whole ecosystem including habitat patch connectivity, matrix permeability and landscape heterogeneity.

Since a lot of species are not evenly distributed, some might be quite common in one part of a region, but threatened in another. In Flanders, this is clearly the case for species such as *Chortippus mollis*, *Gryllus campestris*, *Metrioptera brachyptera*, *Nemobius sylvestris* and *Stetophyma grossum*, which are fairly common in the Campine area, but of least concern in the rest of Flanders, where their biotope is rare. Moreover, nature management plans and species protection plans are set up at different spatial scales and authorities (regions,

provinces, municipalities). Priority lists have been made up for the grasshoppers and crickets occurring in the provinces of Limburg (COLLAZZO & BAUWENS, 2004), Antwerp (ADRIAENS *et al.*, 2009; BECKERS *et al.*, 2009) and Western Flanders (DOCHY *et al.*, 2007). In these lists, the proportion of the regional population that occurs within a province is evaluated (the criterion for inclusion as a priority species is arbitrarily set at one third of the Flemish population). Although this sub-regional prioritisation follows a different methodology than the red list assessment (COLLAZZO & BAUWENS 2004), a threatened (red list) status is still required for selection as a priority species at provincial level. Thus, although this procedure allows for refining species selections relevant for conservation measures and, in the end, a more concentrated expenditure of available funds and personnel for species conservation purposes, it does not account for the aforementioned problem of uneven habitat distributions. One method of overcoming this issue would be to use concepts such as indicator value or flagship character to select additional species. As these rather subjective criteria are hard to quantify, there is a risk of losing policy support for such extensions to the red lists.

When the presented red lists are compared with the previous ones (DECLLEER *et al.*, 2000), it seems that the number of threatened species has decreased. However, caution is needed when performing this exercise, because different criteria were used. In the previous red list, it was assumed that if populations were present after 1990, they were also present at that location before that time. By applying this assumption, species distributions could only decline and, as a consequence, the determination of the status was mainly driven by rarity. Even a species such as *Sphingonotus caerulans*, which had only recently colonised Wallonia, was considered critically endangered. In the red lists that are presented here, the status of a species was determined considering trend as well as rarity.

When Flanders and Wallonia are compared, it is striking that more species became regionally extinct in Flanders, while more species are threatened in Wallonia. Due to the higher human population density and the resulting stronger pressure on the environment as well as the smaller size of nature reserves, the most vulnerable species already became regionally

extinct in Flanders. For none of the species that became extinct, enough suitable habitat is currently present to support sustainable populations and even if present, these species would probably not be able to reach Flanders on their own account anymore. In Wallonia, however, most species can still be preserved if the necessary conservation measures are carried out.

Species richness of grasshoppers and crickets was predicted to decrease significantly due to climate change (MAES *et al.*, 2008). MAES *et al.* (2008) also predicted that specialist grasshopper species such as *Metrioptera bicolor* and *Gomphocerippus rufus* could be lost and replaced by common ones such as *Tettigonia viridissima* and *Leptophyes punctatissima*. However, *T. viridissima* and *L. punctatissima* already occur at most locations where *M. bicolor* and *G. rufus* are currently present (DECLER *et al.*, 2000; Database Saltabel) and replacement is therefore not an issue. In addition, it is very unlikely that *M. bicolor* and *G. rufus* will be lost. *M. bicolor* reaches its northern limit in Belgium (KLEUKERS *et al.*, 1997) and has recently even expanded northward and colonised Flanders (Jacobs *et al.*, 2005) and the Netherlands (FELIX, 2004). *G. rufus* has expanded as well (DECLER *et al.*, 2000; LAMBRECHTS, 2006) and has recently strongly expanded its distribution area in Vlaams-Brabant and Hainaut. Because all grasshopper species occurring in Belgium can also be found in regions south or east of Belgium, which are characterised by a hotter and dryer summers, we expect species loss in Belgium due to climate change to be unlikely. Since regions south of Belgium contain a higher species diversity, species diversity can be expected to further increase. This is already the case with several southern species that recently moved northward, resulting in an expansion in Belgium of species such as *Phaneroptera falcata*, *Meconema meridionale* (Fig. 3), *Conocephalus discolor*, *Oecanthus pellucens* and *Sphingonotus caerulans*. Although the dynamics of grasshopper assemblages in Belgium are still poorly understood and we are unable to predict the long term consequences of these new additions to the Belgian fauna on species or community level (through competitive exclusion or niche segregation), we can expect a net increase in species diversity. Additional species that might be expected to

establish in Belgium in the near future are for example *Ruspolia nitidula*, *Euchorthippus declivus*, *Calliptamus italicus*, *Leptophyes albivittata* and *Platycleis tessellata*.

*Acheta domesticus* is alien to Belgium and therefore, its status is not of concern for nature management. The other reported alien species *Anacridium aegyptium*, *Gryllomorpha dalmatina*, *Gryllus bimaculatus* and *Tachycines asynamorus* have never been common in Belgium and are considered incidental introductions.

Since a few years, it has become very popular to report observations online (see website references below). Using this procedure, the exact location of the observation can easily be indicated on a map. These tools, which also include proper data quality management, procedures for protection of sensitive species information and observation validation tools, are an invaluable source of data for faunistic research. Moreover, online recording tools allow for a very rapid dissemination of new findings and provide a unique knowledge and training base for species recognition amongst the biological recording community. Nevertheless, although these will allow for more accurate species distribution assessments in the future, long term monitoring schemes should be set up and maintained, in order to quantify trends in species population sizes over time, thereby ensuring repeatability of the red list assessment and thus conformity in the lists for this important group of insects. This could be done, depending on target species and habitats, through the set-up of permanent squares or transects, capture-mark-recapture studies, depletion methods or others.

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## References

- ADRIAENS T., DECLEER K. & BECKERS K., 2009. - Sprinkhanen. In: BECKERS K. (Ed.), *Een gericht natuurbeleid voor de prioritaire soorten in de provincie Antwerpen*, Brussel, p. 99-108.
- ADRIAENS D., HONNAY O. & HERMY M., 2006. - No evidence of a plant extinction debt in highly fragmented calcareous grasslands in Belgium. *Biological Conservation*, 133 : 212-224.
- ANDERSEN A.N., LUDWIG J.A., LOWE L.M. & RENTZ D.C.F., 2001. - Grasshopper biodiversity and bioindicators in Australian tropical savannas: Responses to disturbance in Kakadu National Park. *Australian Ecology*, 26 : 213-222.
- BAERT P., 2007a. - *Actieplan Dilsen-Stokkem : Zadelsprinkhaan*. Limburgse soorten 9, Het Groene Huis, Genk, 85 pp.
- BAERT P., 2007b. - *Actieplan Houthalen-Helchteren : Wekkertje*. Limburgse soorten 22, Het Groene Huis, Genk, 107 pp.
- BAERT P., 2007c. - *Actieplan Meeuwen-Gruitrode : Boskrekkel*. Limburgse soorten 31, Het Groene Huis, Genk, 95 pp.
- BECKERS K., VERMEERSCH G, MAES D., ADRIAENS T., DE BEER D., DE KNIJF G., BOSMANS R., HENDRICKX F., JOORIS R., MAELFAIT J.-P., VAN DEN BERGE K., VAN KEER K., VAN LANDUYT W. & VAN THUYNE G., 2009. - *Een gericht natuurbeleid voor de prioritaire soorten in de provincie Antwerpen*. Rapport van het Instituut voor Natuur- en Bosonderzoek INBO.R.2009.7 i.o. van de Provincie Antwerpen, Brussel.
- COLLAZZO S. & BAUWENS D., 2004. - *Criteria voor het aanwijzen van prioritaire soorten voor het natuurbehoud in de provincie Limburg*. Verslag van het Instituut voor Natuurbehoud. Studie uitgevoerd i.s.m. de provincie Limburg in het kader van LIKONA. IN.A.2003.5, Brussel.
- DECLEER K., DEVRIESE H., HOFMANS K., LOCK K., BARENBURG B., MAES D., 2000. - *Voorlopige atlas en "rode lijst" van de sprinkhanen en krekels van België (Insecta, Orthoptera)*. Werkgroep Saltabel i.s.m. I.N. en K.B.I.N., Rapport Instituut voor Natuurbehoud 2000/10, Brussel, 75 pp. / *Atlas et "liste rouge" provisoire des sauterelles, grillons et criquets de Belgique (Insecta, Orthoptera)*. Groupe de travail Saltabel e.c.a. I.N. et I.R.S.N.B., Rapport Instituut voor Natuurbehoud 2000/10, Bruxelles, 75 pp.
- DECLEER K., VANROOSE S., DEVRIESE R., HOFMANS K., LOCK K., 2002. - Status en trends van de Belgische sprinkhanen en krekels (Orthoptera). *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique, Biologie*, 72-suppl. : 115-117.
- DE KNIJF G., 2006. - De rode lijst van de libellen in Vlaanderen. In: DE KNIJF G., ANSELIN A., GOFFART P. & TAILLY M. (Eds.), *De Libellen (Odonata) van België: verspreiding – evolutie – habitats*. Libellenwerkgroep Gomphus i.s.m. Instituut voor Natuur- en Bosonderzoek, Brussel, p. 241-257.
- DOCHY O., BAUWENS D., MAES D., ADRIAENS T., VRIELYNCK S. & DECLEER K., 2007. - *Prioritaire en symboolsoorten voor soortbescherming in West-Vlaanderen*. Rapporten van het Instituut voor Natuur- en Bosonderzoek INBO.R.2007.13., Brussel.
- EYKENS C., 2008. - Gedrag van de zadelsprinkhaan (*Ephippiger ephippiger*) in Limburg. Eindwerk Katholieke Hogeschool Kempen.
- FELIX R., 2004. - De eerste vondst van de Lichtgroene sabelsprinkhaan *Metrioptera bicolor* in Nederland (Orthoptera: Tettigoniidae). *Nederlandse Faunistische Mededelingen*, 21 : 7-10.
- GRAITSON E., SAN MARTIN G. & GOFFART P., 2005. - Intérêt et particularités des haldes calaminaires wallonnes pour l'entomofaune: le cas des Lépidoptères Rhopalocères et des Orthoptères. *Notes Fauniques de Gembloux*, 57 : 49-57.
- IUCN, 1994. - *IUCN red list categories and criteria*. IUCN species survival commission, Gland, 32 pp.
- IUCN, 2001. - *IUCN red list categories and criteria*. IUCN species survival commission, Gland, 32 pp.
- IUCN, 2003. - *Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0*. IUCN Species Survival Commission. IUCN, Gland, 26 pp. [http://www.iucnredlist.org/documents/reg\\_guidelines\\_en.pdf](http://www.iucnredlist.org/documents/reg_guidelines_en.pdf)
- JACOBS M., CORTENS J. & VERAGHTERT W., 2005. - Zuidelijke sprinkhanen vinden hun weg naar Vlaanderen. *Natuurfocus*, 4 : 31-32.
- KLEUKERS R., 2004. - *De sprinkhanen van Nederland en België*. Jeugdbondsuitgeverij, Utrecht, 80pp.
- KLEUKERS R.M.J.C., VAN NIEUKERKEN E.J., ODÉ B., WILLEMSE L.P.M. & VAN WINGERDEN W.K.R.E., 1997. - *De sprinkhanen en krekels van Nederland (Orthoptera)*. Nederlandse Fauna 1, Nationaal Natuurhistorisch Museum, KNNV Uitgeverij & EIS-Nederland, Leiden, 416pp.
- KLEUKERS R. & KREKELS R. (2004). - *Veldgids sprinkhanen en krekels*. Stichting Uitgeverij van de Koninklijke Nederlandse Natuurhistorische Vereniging, Utrecht, 192 pp.
- LAMBRECHTS J. (2006). - Vierde populatie Rosse sprinkhaan. *Natuur.Focus*, 5 : 67-68.
- LAMBRECHTS J., ADRIAENS P. & DECLEER K. (2006). - Sprinkhanen in het Nationaal Park Hoge Kempen. *LIKONA jaarboek*, 15 : 58-65.
- LEE M., 2004. - Bat detectors - a beginner's guide for orthopterists. January 2004 [www.ercis.co.uk](http://www.ercis.co.uk) <http://www.ercis.co.uk/Resources/ERCCIS/batdetectorspdf.pdf>
- LOCK K., 2002. - De Wrattenbijter (*Decticus verrucivorus*) : (nog) niet uitgestorven in België! *Saltabel*, 19 : 15-16.

- MAES D., GHESQUIERE A., LOGIE M. & BONTE D., 2006. - Habitat use and mobility of two threatened coastal dune insects: implications for conservation. *Journal of Insect Conservation*, 10 : 105-115.
- MAES D., ANSELIN A., DECLEER K., DE KNIJF G. & FICHEFET V., 2008. - Insecten en klimaatwijziging in België. Van de regen in de drup... *Natuurfocus*, 7 : 107-111.
- MAES D., DECLEER K., DE BRUYN L., HOFFMANN M., 2011a. Nieuwe rode lijstcategorieën en -criteria voor Vlaanderen: een aanpassing aan de internationale IUCN-standaarden. *Natuur.Focus*, 10 : 54-61.
- MAES D., VANREUSEL W., JACOBS I., BERWAERTS K., VAN DYCK H., 2011b. Een nieuwe rode lijst dagvlinders: de IUCN-criteria toegepast in Vlaanderen. *Natuur.Focus*, 10 : 62-71.
- PROVOOST S., VAN GOMPEL W., FEYS S., VERCRUYSE W., PACKET J., VAN LIEROP F., ADAMS Y. & DENYS L., 2010. - Permanente inventarisatie van de natuurreservaten aan de kust: eindrapport periode 2007-2010. Rapporten van het Instituut voor Natuur- en Bosonderzoek 2010 (19), Brussel.
- SAN MARTIN G., GOSSE D., VANDEN BORRE J. & ARIJS G., 2006. - Atlas van de sprinkhanen van Brussel – Atlas des Orthoptères (criquets et sauterelles) de Bruxelles. *Contactblad SaltaBru project – Feuille de Contact projet SaltaBru*, 3 : 1-11.
- TILMAN D., MAY R.M., LEHMAN C.L. & NOWAK M.A., 1994. - Habitat destruction and the extinction debt. *Nature*, 371 : 65-66.
- VERCRUYSE W. & DE RYCKE J., 2008. - Zaagsprinkhanen in Meerdaalwoud: een nieuwe soort voor Vlaanderen. *Natuurfocus*, 7 : 112-115.
- VAN DELFT J., VAN DER BERG A. & HAVEMAN R., 2000. - Nieuwe vindplaatsen van de zadelsprinkhaan *Ephippiger ephippiger* op de noordelijke Veluwe (Orthoptera: Tettigoniidae). *Nederlandse Faunistische Mededelingen*, 12 : 33-39.

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## Muscidae and Syrphidae (Diptera) collected by window-trapping at the IJzer estuary (Belgian coast)

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### Abstract

By means of window-trapping Muscidae and Syrphidae (Diptera) were collected in the fore-dunes, grey dunes and in the old and new salt marshes of the IJzer estuary (Belgian coast). The Syrphidae are mainly represented by migratory species. The Muscidae are ubiquitous, except for *Helina protuberans*, which is a typical species for sand dunes. We discuss the absence of other habitat specialists. Also some notes are included on *Hydrotaea aenescens* (Muscidae), which is reported for the first time from Belgium.

**Keywords:** *Hydrotaea aenescens*, *Helina protuberans*, window trapping, dunes, salt marshes

### Samenvatting

Door middel van venstervallen werden Muscidae and Syrphidae (Diptera) verzameld in de zeereepduinen, de grijze duinen en in de oude en nieuwe schorren van de IJzermonding (Belgische kust). We geven hier de resultaten weer alsook een soortenlijst van deze staalname tijdens 2006 en 2009. De Syrphidae worden vooral vertegenwoordigd door migrerende soorten. Met uitzondering van *Helina protuberans*, een typische soort van zandduinen, zijn de Muscidae-soorten ubiquisten. De