

GREGARIOUSNESS AMONGST LATE MAASTRICHTIAN COMATULID CRINOIDS

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Recent discoveries of large numbers of dissociated crinoid ossicles, including centrodorsals, basals, radials, brachials, cirrals, and pinnulars, all of them belonging to comatulids, in the upper part of the Maastrichtian in its type area are briefly discussed. Occurrences like these should be given the closest possible attention, since they provide opportunities to analyse ontogenetic peculiarities, range of variation and life habit of the species concerned. Three examples are here chosen for discussion. Firstly, almost all ossicles, including those of the arms, of the notocrinid *Semiometra impressa* sensu H.W. Rasmussen, 1961 (? non Carpenter, 1881) have been recognised from the middle Nekum Member (Maastricht Formation) as exposed at the CBR-Romontbos quarry (Eben Emael-Bassenge, Liège, Belgium). Secondly, large numbers of centrodorsals, radials, basals and brachials of *Jaekelometra* spp. have recently been collected from the uppermost Meerssen Member (Maastricht Formation) at the ENCI NV quarry (Maastricht). Associated with this atelecrid genus, rare specimens of the notocrinid *S. impressa* and the conometrid *Amphorometra* have been found. The third example concerns a similar occurrence (mainly of thecae of *Jaekelometra*) in the lower part of the Meerssen Member as exposed at the Ankersmit Holding BV quarry (formerly Nekami), Bemelen (Limburg, The Netherlands). Some preliminary observations as to the value of such occurrences are added, as are a few important literature data.

The crinoid fauna of the Upper Cretaceous (Campanian-Maastrichtian) of the type area of the Maastrichtian Stage (SE Netherlands and NE Belgium) is still rather poorly known. BOSQUET (in STARING, 1860, and in DEWALQUE, 1868) listed (in original nomenclature) the following species: *Comatula conoidea*, Goldf. sp., *Glenotremites paradoxus*, Goldf., *Eugenocrinus Hagenovi*, Goldf., *Bourgueticrinus* (sic, also spelt *Bourgetocrinus*) *ellipticus*, Mill., *B. aequalis*, d'Orb., *Hertha mystica*, Hag. and *Pentacrinus Agassizi*, Hag. Where the original material is still available, most of these identifications have proved to be erroneous (see RASMUSSEN, 1961), which makes lists like these unreliable. SCHLÜTER (1878) was the first to illustrate and describe in detail comatulid crinoids from the Maastrichtian of the area, viz. *Antedon lenticularis* and *A. concavus*. Later studies include JAEKEL (1901), GISLÉN (1924) and RASMUSSEN (1961, 1965). The latter author listed

four isocrinids, one bourgueticrinid, one holopodid and seven comatulids, almost all of which have been recognised from recently accumulated collections. JAGT (1986a) redescribed Rasmussen's *Cyathidium holopus* as a new species, *C. vliexi*, while JAGT (1986b) recorded several species of *Bourgueticrinus* from the area. Preliminary data furnished by JAGT (1988) indicate that bourgueticrinids with primibrachials 2 (1Br₂) remarkably similar to those of the bathytrichid *Dunnocrinus mississippiensis* Moore (1967, pl. 7, figs 14a-e) dominate the crinoid assemblages of the upper part of the Gulpen Formation (Lanaye Member), while comatulids are very common especially in the upper part of the Maastricht Formation (Nekum and Meerssen Members). Over the past few years, a number of very interesting crinoid species have been collected from the Campanian-Maastrichtian strata in the area, most of which are new to science. These in-

clude bourgueticrinids (possibly also bathytrichids), comatulids, and, most surprisingly, roveacrinids (JAGT, in prep. a). This latter group is remarkably diverse and comprises the stratigraphically youngest representatives of this order known to date, extending the known range to the late Maastrichtian (see RASMUSSEN, 1978; SIMMS, 1988). Detailed analyses of bioclast assemblages from the Upper Cretaceous strata in the Maastrichtian type area and beyond (see BLESS *et al.*, 1986; P.J. FELDER *et al.*, 1985a, 1985b; P.J. FELDER, 1988; P.J. FELDER & BLESS, 1989; ROBASZYNSKI *et al.*, 1985) indicate that, normally, crinoids are amongst the less well-represented echinoderm groups. Locally however, crinoid ossicles are extremely common, and it is occurrences like these that deserve the closest possible attention. They should preferably be extensively sampled, carefully processed and hand-picked in order to obtain as many ossicles (including brachials, cirrals and pinnulars) as possible. Three of such occurrences are here briefly described, mainly with the aim of stimulating collectors to pay particular attention to them. In this way, hopefully, large samples of these crinoids will eventually be available for study. The reader is referred to JAGT (in prep. b) for further details.

In order to facilitate recognition of the species discussed below, diagrammatic representations of centrodorsals and thecae of species of the genera *Jaekelometra*, *Semiometra* and *Amphorometra* (Figs 1-3) are included.

DISCUSSION

The three examples cited above will be treated separately below.

—CBR Romontbos quarry (Eben Emael, Bassenge, Liège)

In the middle part of the Nekum Member as exposed at this quarry (see W.M. FELDER, 1975) a so-called echinoderm breccia was extensively sampled by private collectors some years ago. It yielded, amongst other echinoderm remains, surprisingly many thecae and centrodorsals of the notocrinid

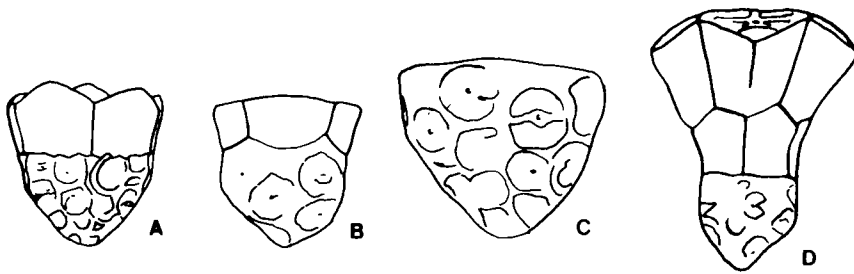


Figure 1A-D Diagrammatic representations of three species of *Jaekelometra* recorded from the type Maastrichtian. A - *Jaekelometra columnaris* Gislén, 1924. B and D - *J. belgica* (Jaekel, 1901). C - *J. concava* (Schlüter, 1878). Modified after Gislén (1924) and Rasmussen (1961). Magnifications: x 5 (A), x 6 (D), x 10 (B-C).



Figure 2 Diagrammatic representation of *Semiometra impressa* sensu Rasmussen, 1961 (? non Carpenter, 1881). Modified after Rasmussen (1961), magnification x 5.

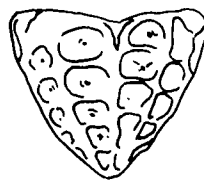


Figure 3 Diagrammatic representation of *Amphorometra conoidea* (Goldfuss, 1839). Modified after Rasmussen (1961), magnification x 10.

comatulid *Semiometra impressa* sensu Rasmussen (1961, p. 309, pl. 45, fig. 2), in addition to thousands of dissociated brachials and cirrals. Isolated radials and basals were also found. Since these samples yielded only very few centrodorsals of *Jaekelometra* sp., nearly all ossicles found can be referred to *Semiometra impressa* confidently. Most specimens appear to be fully-grown individuals, but very small centrodorsals (1-2 mm diameter) have also been collected. The fact that immature specimens are present as well provides opportunities to analyse ontogenetic development of this species, in the same way as PECK & WATKINS (1972) have done. In this respect it is very unfortunate that the characteristic recrystallisation (which becomes especially prominent in the coarse-grained biocalcarenites of the Nekum and Meerssen Members) tends to obliterate surface sculpture of the centrodorsals and thecae. Despite these difficulties, the samples collected will be analysed in detail in the near future, with the aim of presenting a clear picture of the species' ontogeny, its range of variation and its structure. GISLÉN (1934) and SIEVERTS-DORECK (1961) are excellent examples of how to go about such a project; PAUL & DONOVAN (in SMITH *et al.*, 1988) are also referred to for a useful discussion of a comatulid crinoid fauna.

— ENCI NV quarry (Maastricht, Limburg, The Netherlands)

In the uppermost part of the section exposed at this quarry (see Figure 4), in the upper Meerssen Member (late Maastrichtian), recent quarrying activities have made accessible several highly fossiliferous bryozoan layers, which are practically always associated with hardground phenomena (see VOIGT, 1959). Amongst numerous, often well-preserved bryozoans, micromorphic brachiopods, benthic foraminifers, saleniid, cidarid, diadematid, arabaciid and cassidulid echinoids, gonistasterid asteroids and other groups these layers have yielded many dissociated remains of comatulid crinoids. *Semiometra impressa* appears to be extremely rare, while *Amphorometra* (probably *A. conoidea*) has been found to occur somewhat more frequently. Most of the material (including well-preserved radials, brachials, centrodorsals, and rare basals) belongs to *Jaekelometra*. Complete thecae have so far not been found: the centrodorsals are generally fairly well preserved, but many have suffered from extensive recrystallisation, while still others are partly abraded. Broken specimens have also been found, which may suggest predation. The most interesting fact about this faunule is that immature as well as fully-grown individuals are present, which implies that a genuine population is

here represented. The smallest radials in a sample (Jagt Collection) measure 1 mm (height), while the largest specimens reach 4 mm (height). Remarkable is the almost complete lack of cirrals in the samples studied so far; some isolated cirrals have been found, but these seem too massive to belong to *Jaekelometra*. Surprising as well is the fact that only very few basals have so far been recognised; in one case they are still *in situ* on top of the centrodorsal of a specimen of average size. All brachials have a characteristic crest on their outer surface, which corresponds to the one found on the radials (see Fig. 1D; RASMUSSEN, 1978). This, and the fact that *Semiometra* and *Amphorometra* are rare in the samples studied, and appear to have utterly different brachials (see RASMUSSEN, 1961, 1978), suggests that all these remains may safely be referred to *Jaekelometra*. They will be described in detail in a paper now in preparation; interestingly, *lBrr2* is axillary. Hopefully, such an analysis of a large sample will provide opportunities to critically revise the status of the various species of *Jaekelometra*, since the differences between these appear to be less clear cut than suggested in the literature (see GISLÉN, 1924; RASMUSSEN, 1961).

— Ankersmit Holding BV (Nekami) quarry (Bemelen, Limburg, the Netherlands)

A comparable crinoid faunule in which *Jaekelometra* dominates occurred in the lower part of the Meerssen Member (Maastricht Formation) as exposed at this quarry (see Fig. 4). Several samples have been cursorily studied: these comprise well-preserved thecae (compare Fig. 1D), disarticulated basal/radial rings and centrodorsals. Brachials, cirrals and pinnulars have not been seen, but this is probably due to inadequate processing of the samples, as is the virtual lack of very small, immature specimens. It is here advised to sample the locality again (if possible, of course), in order to obtain a collection that can be reliably compared with the material from the ENCI quarry as far as analysing the population structure is concerned.

LITERATURE DATA AND CONCLUSIONS

In the extensive literature on Recent crinoids, data on life habit and community structure concern mainly representatives of the suborder Comatulidina (sen-

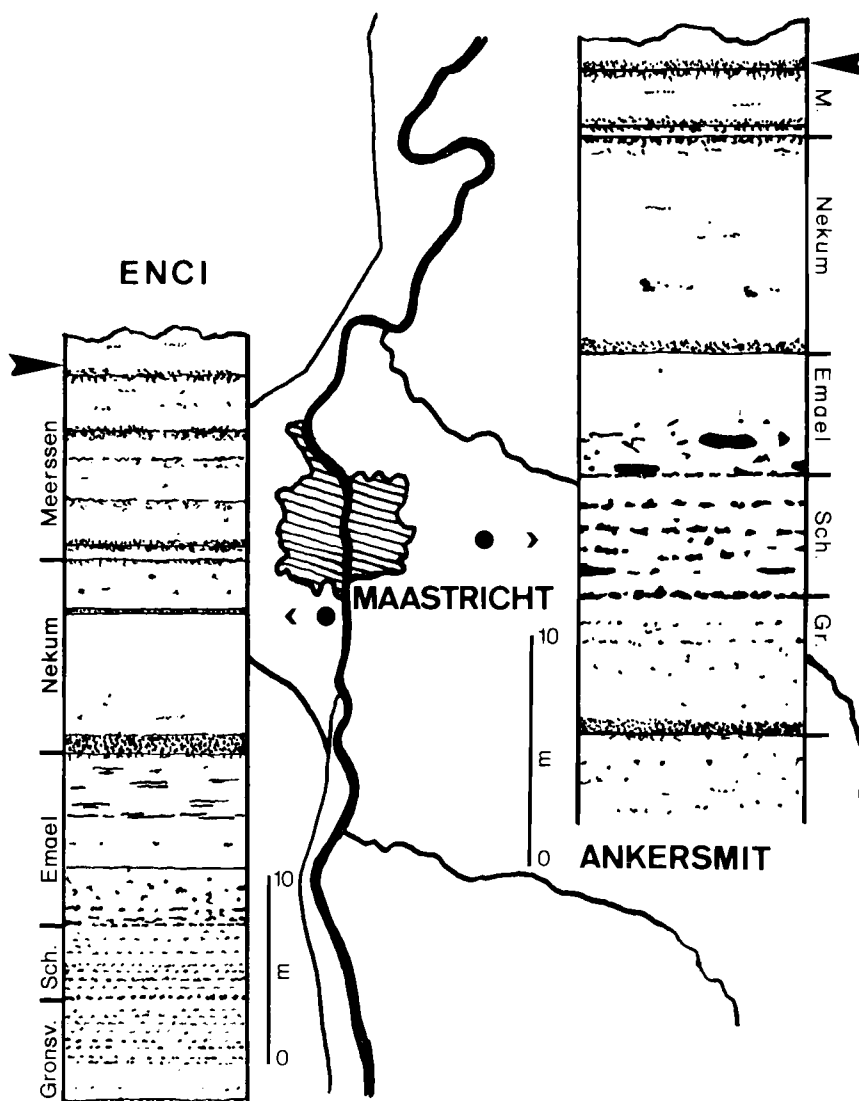


Figure 4 Simplified locality map of the Maastricht area (The Netherlands), lithostratigraphic logs of the sections exposed at the ENCI NV quarry (Maastricht) and at the Ankersmit (Nekami) quarry (Bemelen) and indications of the provenance (arrows) of the material briefly described herein. The logs are after W.M. Felder et al. (1978).

su SIMMS, 1988). Studies on fossil comatulids are almost invariably taxonomic in nature, focus primarily on the structure of centrodorsals and/or theca and often lack descriptions of other ossicles, e.g. brachials, cirrals and pinnulars. In this respect, I concur with MOORE et al. (1953, p. 604), who remarked that, 'A point deserving stress is that completeness of fossil crinoid specimens is not a measure of their worth to paleontology, because a surprisingly large volume of precise and useful knowledge can be gained from the study of crinoid fragments. At present, this is a largely neglected field.' GISLÉN (1934) is a good example of what may be achieved in this field.

MEYER & MACURDA (1977) have studied the adaptive radiation of comatulid crinoids and presented data on morphology (brachial articulation and muscula-

tion), niche adaptation and locomotory capabilities. Comatulids dominate modern crinoid communities and show the highest grade of evolutionary development amongst Recent crinoids. Special adaptations (complex brachial muscularization) allow them to actively crawl and even swim, which means that they are more flexible in the choice of habitat and can escape more easily from stress or from predators than their stalked isocrinid allies. Studies on Recent comatulids however, show them to be living as functional stalked crinoids in many cases, with the cirri providing attachment to the substratum. BREIMER & LANE (1978) in their valuable overview of crinoid ecology and palaeoecology stressed the value of studies on modern crinoids in their natural habitats and of interpretations of functional morphology in reconstructing the

life habits of fossil representatives. All crinoids are suspension feeders and the least vulnerable and most efficient amongst them are the comatulids. These have a free-living adult stage, can swim actively and select optimum sites and are thus capable of exploiting different ecologic niches. It has been pointed out in the literature that most species are restricted to particular sites in highly complex ecosystems. Several co-occurring species show characteristic microhabitat preferences. LANE (1978, p. T343) stressed the tendency of crinoids to occur in close proximity to each other, which is certainly advantageous as far as ensuring offspring is concerned. Lane also pointed out that studies of individual crinoid ossicles are important in reconstructing the evolution and structure of fossil crinoid communities.

The reader is referred to BREIMER & LANE (1978) for a more extensive discussion of crinoid ecology. Below some preliminary observations on the occurrence of comatulids described above will be presented. A detailed analysis of morphology, community structure and life habit will be deferred to another occasion.

What is most interesting in two of the three examples here given, is the fact that immature as well as fully-grown individuals are found, and that nearly all ossicles can be recognised. This suggests that these occurrences represent genuine populations, which have not, or on a very limited scale, been transported from their original sites. As pointed out above, a certain number of centrodorsals of *Jaekelometra* show traces of wear, which may have resulted from transport over short distances. Still other specimens are perfect as far as preservation is concerned. The association of the centrodorsals with other ossicles that can undoubtedly be referred to the same genus, and the rarity of other species (such as *Semiometra* and *Amphorometra*) suggests that the environment of the bryozoan layers was an optimum microhabitat for these forms. The roveacrinids encountered in these samples (ENCI NV, Meerssen Member) need not be considered, since these are pelagic organisms that become part of benthic associations only after death. The virtual lack of cirrals and pinnulars in the samples dominated by *Jaekelometra* is puzzling; it is hoped that additional sampling will offer explanations. The occurrence of an optimum site for a certain species is also shown in the case of *Semiometra* (CBR-Romontbos, Nekum Member), which is

associated with only few centrodorsals of *Jaekelometra*. Whether these are to be considered stray specimens or occupants of a different, adjoining microhabitat remains to be determined.

The purpose of this short paper is mainly to stress that crinoid faunules such as the ones described above deserve the closest possible attention. Not only do they provide opportunities to reconstruct the animals from dissociated ossicles, but they also allow precise data on community structure, ontogenetic peculiarities and life habit when properly sampled, processed and analysed. In cases like these, it would indeed be a good thing if the gregariousness amongst these comatulid crinoids were to trigger off a positive greed in many a collector.

SAMENVATTING

GEZELLIGHEID BIJ COMATULIDE ZEELELIES UIT HET LAAT-KRIJGT

Onlangs zijn grote hoeveelheden geïsoleerde skeletdelen van comatulide zeelelies (centrodorsalen, basalen, radialen, brachialen, cirralen en pinnularen) in het jongste deel van het type-Maastrichtien aangetroffen. Geadviseerd wordt dat dit soort voorkomens de hoogste prioriteit gegeven moet worden, aangezien hier mogelijkheden liggen tot het reconstrueren van de dieren uit de afzonderlijke elementen van het skelet. Daarnaast zijn gegevens over de ontwikkeling van juveniel tot volwassen dier, zijn variatiebreedte en zijn leefmilieu uit dit soort voorkomens te verkrijgen, mits ze grootschalig bemonsterd, zorgvuldig bewerkt en geanalyseerd worden. Drie voorbeelden van een dergelijk voorkomen worden hier kort voorgesteld; een uitgebreide beschrijving met afbeeldingen zal later volgen.

De zeeleelifauna van de Campanien-Maastrichtien afzettingen in het typegebied van het Maastrichtien (ruwweg de driehoek Maastricht-Luik-Aken) is nog steeds slecht bekend. Oudere literatuur is vaak onbetrouwbaar en zeer beperkt. Recent verzameld materiaal heeft aangetoond dat een rijke, gevarieerde zeeleelifauna aanwezig was, en dat veel van deze soorten nog onbeschreven zijn. Opvallend daarbij is de variatie die aangetroffen is bij planktonische zeelelies (Roveacrinida), waarbij nog komt dat de bij Maastricht gevonden soorten de tot nu toe geologisch jongste vertegenwoordigers van deze groep zijn.

Uit de Nekum Kalksteen ontsloten in de groeve CBR-Romontbos (Eben-Emael, Luik) wordt een voorkomen van *Semio-metra impressa* kort beschreven, waarbij zowel onvolwassen als ook volgroeide individuen optreden. Een vergelijkbaar voorkomen wordt gemeld uit de ENCI groeve (Maastricht), maar hier domineert *Jaekelometra*. Hiervan zijn praktisch alle skeletdelen herkend; dit in tegenstelling tot een soortgelijk voorkomen in de Meerssen Kalksteen van de groeve Nekami (Ankersmit) bij Bemelen, waarandaan complete kellen bekend zijn. Enkele literatuurgegevens worden kort besproken, vooral met het oog op het voorkomen van bepaalde soorten in bepaalde mikrobiotopen. Comatuliden zijn ongetwijfeld de meest succesvolle crinoiden: ze kunnen actief zwemmen en zijn in staat optimale omstandigheden op de zeebodem op te zoeken, dit in tegenstelling tot hun steeldragende verwanten die plaatsgebonden zijn. Uit het feit dat verschillende soorten zich specialiseren, hoewel ze in hetzelfde milieu leven, valt af te leiden dat deze dieren in staat zijn zich aan te passen aan allerlei ecologische niches. Om deze specialisatie ook bij fossiele soorten aan te kunnen tonen, is het noodzakelijk dat gekonsentreerde voorkomens van de soort zoals hier beschreven, met grote zorg behandeld worden. Het is duidelijk dat voor een uitgebreide analyse een zo groot mogelijke hoeveelheid materiaal nodig is, en het zou daarom heel goed zijn als deze gezelligheid onder comatulide zeelelies een gezonde verzamelwoede bij (amateur-) paleontologen los zou kunnen maken.

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KORTE MEDEDELINGEN

INVENTARISATIE SPRINKHANEN EN KREKELS VAN NEDERLAND

Van 1990 t/m 1993 zal EIS (European Invertebrate Survey)-Nederland de sprinkhanen en krekels (Orthoptera) van Nederland inventariseren.

Van de 39 inheemse soorten zal de verspreiding en biotoopkeuze bepaald worden. Verder wordt er aandacht geschonken aan de oecologie van deze dieren en zullen de veranderingen in de loop van de tijd in kaart gebracht worden. Er zal worden samengewerkt met Dr. W.K.R.E. van Wingerden van het Rijksinstituut voor Natuurbeheer.

Iedereen die zich interesseert voor insecten en graag wat meer wil weten over sprinkhanen en krekels, kan meewerken aan dit project.

Orthoptera zijn relatief grote dieren, die vaak in grote aantallen voorkomen en relatief goed te determineren zijn. Het determineren van sprinkhanen gebeurt met behulp van een determinatiesleutel, waarin op basis van verschillen in lichaamsbouw de soorten worden uitgesplitst (vergelijkbaar met de werking van de flora). Voor het Nederlandse gebied is er hiervoor uitstekende literatuur beschikbaar.

Buiten de verschillen in lichaamsbouw, onderscheiden de soorten zich ook door het geluid dat ze produceren. Met behulp van geluidsdiagrammen of cassettebandjes kunnen de meeste soorten na enige oefening ook op geluid snel herkend worden.

De combinatie van een beperkt aantal soorten, een veelal opvallende levenswijze en goede literatuur maakt de Orthoptera tot een groep insecten die elk geïnteresseerde natuurliefhebber in korte tijd kan leren kennen. Om nieuwe medewerkers wat op weg te helpen, zullen er instructiedagen worden georganiseerd. Een instructiedag kan

bestaan uit een excursie in een gebied met een rijke sprinkhanenfauna, waarbij wordt ingegaan op het inventariseren en determineren van Nederlandse Orthoptera. Ook zal er aandacht besteed worden aan het leren kennen van een aantal geluiden.

Alhoewel de tijdsinvestering per gebied relatief gering is, is de groep mensen die gegevens verzamelt over Orthoptera nog veel te klein om in het bestek van vier jaar een volledig verspreidingsbeeld van alle soorten te verkrijgen. Mensen die geïnteresseerd zijn in het meewerken aan deze katering wordt daarom gevraagd zich op te geven op onderstaand adres. Iedere medewerker kan zelf bepalen hoeveel tijd er in het project geïnvesteerd wordt. In de praktijk zal het er vaak op neer komen dat een medewerker het gebied, dat hij of zij toch al vaak bezoekt, eens gaat onderzoeken op het voorkomen van Orthoptera. Dit zal dan vooral plaatsvinden in de periode juli-september wanneer de eerste soorten volwassen zijn.

Medewerkers zullen na inschrijving een gratis determinatietabel ontvangen en verder zullen zij de EIS-nieuwsbrief jaarlijks thuisbezorgd krijgen. Hierin verschijnen artikelen over de verspreiding en oecologie van allerlei groepen ongewervelde dieren. De handleiding bij het project zal, samen met een aantal waarnemingsformulieren, vóór het veldwerkseizoen (juli-oktober) worden opgestuurd.

Mensen die niet willen deelnemen aan het project maar wel nog waarnemingen van Orthoptera bezitten (uit heden of verleden) wordt ook opgeroepen deze door te geven aan EIS. Dus als iemand bijvoorbeeld nog weet waar veldkrekels of veenmollen zitten of gezeten hebben, geef het a.u.b. door! Vóór deelname aan het project kan een briefkaart (o.v.v. 'opgave sprinkhanen-project') gestuurd worden naar EIS-Nederland, t.a.v. ondergetekende

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In Limburg komt de *Struiksprinkhaan* (*Leptohyes punctatissima*) algemeen in het zuiden en het noorden voor. In Midden-Limburg lijkt deze *sabelsprinkhaan* veel zeldzamer te zijn.