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Grasshoppers, Crickets and Bush-Crickets in Devon

Martin Davies

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INTRODUCTION

There can be few sounds so evocative of warm, sunny, summer afternoons than the gentle chirruping of grasshoppers. Lying on a grassy Devon bank listening to this familiar chorus, one could be forgiven for thinking that grasshoppers must be a well-studied group. Though certainly better understood than some groups of insects, in contrast to butterflies for example comparatively little is known about the British grasshopper species and their relatives, and they still offer a rich area of study.

Dragonflies were once described as "birdwatcher's insects" because they are large, colourful and relatively easy to see (indeed in recent years thanks to new identification guides, they seem to have become just that) But surely grasshoppers ought to be a strong contender for this title as well—not only are they also large, colourful and easy to see but like birds they hop, fly and even sing.

The purpose of this present paper is not to aim at some scholarly definitive statement of the detailed status of Orthoptera in Devon, but rather to try to share something of the interest and fascination that I have gained from study of this somewhat neglected group mainly in east and south Devon, and hopefully to stimulate and encourage a wider interest in our native grasshoppers, cricket and bush-crickets.

Books

It is perhaps the lack of a generally available reference book on the subject which has hindered popular study of this fascinating group of insects. David Ragge's (1965) excellent monograph on the "Grasshoppers, crickets and cockroaches of the British Isles", updated by a supplement (Ragge 1973), has sadly long been out of print and is virtually unobtainable. When published this book was even accompanied by a small gramophone disc with recordings of the songs of the various species.

Earlier books, such as Lucas (1920), Burr (1936) and Pickard (1954) can be a bit confusing since many of the species names have changed, but Haes (1973) useful little booklet is a handy summary, though difficult to obtain.

The gap has been at least partly filled by the Cambridge University Press booklet "Grasshoppers" by Valerie Brown (1983) which includes some splendid chapters on various aspects of grasshopper biology. A selection of the British grasshopper and bush-cricket species (but not crickets) are illustrated in colour but it was perhaps an opportunity missed not to have added the few species which would have made these plates complete. However the new "Collins Guide to the Insects of Britain and Western Europe" (Chinery 1986) contains an excellent section on Orthoptera including a description and illustrations of 24 of our 28 native species. Nonetheless Ragge (1973) still remains the best comprehensive reference and if you can get hold of a copy it will rapidly become a treasured possession.

Excellent news on the horizon is of a brand new book to be published later this year covering all the British Orthoptera entitled "Grasshoppers and Allied Insects of Great Britain and Ireland" by J.A. Marshall and E.C.M. Haes (1987/88—in prep.). A companion tape produced by J.. Burton with commentary by D.R. Ragge is also being issued and will cover all British Orthoptera which stridulate. Such a book will be broadly welcomed I'm sure, and open out study of our native Orthoptera to the audience it deserves.

THE FAMILIES OF ORTHOPTERA

The grasshoppers, crickets and bush-crickets all belong to the Order of insects called the *Orthoptera*. The detailed structure varies enormously between species, but all *Orthoptera* have characteristically enlarged hind legs . The thorax (the section of the body just behind the head) is covered by a hardened saddle-like structure called the pronotum. This is an useful feature since the pattern of ridges on the pronotum is often an aid to species identification—(see Figure 1).

The *Orthoptera* is divided into various families and before considering the individual species it is important to sort out the distinction between these main family groupings.

The familiar grasshoppers belong to the family *ACRIDIDAE* which typically have relatively short thick antennae (see Plate 1) and produce their chirruping "song" (or *stridulation* to give it the correct technical name) by rubbing their hind pair of legs against the flexed forewings. On the inside of the femur (the large innermost segment of the leg containing the main muscles for jumping) there is a row of tiny pegs which during stridulation are rubbed against the prominent veins of the forewing causing the wing to vibrate. The sound is thus produced in much the same way as pulling the teeth of a comb across the thin edge of a ruler.

The bush-crickets, true crickets and mole crickets, produce their sounds in a totally different way, essentially by rubbing their wings together. In the bush-crickets, a tooth-bearing rib on the left fore wing is rubbed against the hind edge of the right forewing so causing it to vibrate; in the true crickets and mole-crickets strangely enough it is the other way round, with the right forewing rubbed against the left!

The bush-crickets belong to the family *TETTIGONIIDAE* and in the past have confusingly been called "long-horned grasshoppers" (or in America "Katydids"). This does however serve to emphasize their most obvious characteristic feature, their tremendously long thread-like antennae which in all the British species greatly exceed the length of the rest of the body (see Plate 2). In comparison to grasshoppers, bush-crickets generally have rather long gangly hind legs and tend to crawl, shuffle or run rather than jump. Whereas grasshoppers are very much creatures of the sun, bush-crickets are mainly crepuscular or nocturnal in their activities or at least seldom active much before the latter part of the afternoon. The long ovipositor of female bush-crickets is often a distinctive, indeed fearsome-looking (though harmless) feature, and in some species it is not only long, but curved and shaped like a sabre!

Eleven species of *ACRIDIDAE* (grasshoppers) and ten species of *TETTIGONIIDAE* (bush-crickets) occur in Britain comprising the majority of our 28 native species. The remainder are representatives of three other families:-

the subterranean Mole Cricket *(GRYLLOTALAIDAE)* with its extraordinary enlarged forelegs used in digging,

three species of True Crickets *(GRYLLIDAE)*, which have long thread-like antennae and a rounded head shape,

three species of Groundhoppers *(TETRIGIDAE)*—small grasshopper-like insects in which the pronotum is greatly extended backwards to cover the whole of the top of the abdomen.

Most of the true crickets are omnivorous, whilst grasshoppers eat almost entirely vegetable matters. Bush-crickets, in contrast, are mainly carnivorous, feeding primarily on other insects and are not averse to cannabilism if the opportunity presents itself!

All the British Orthoptera other than the Mole Cricket and Field Cricket overwinter in the egg stage. In the grasshoppers up to 14 eggs are contained in an egg-pod which is inserted either just below the surface of the soil or in the base of grass tussocks. The true crickets lay their eggs singly on the ground, as does the Great Green Bush-Cricket, but in most of the other bush-cricket species it is laid amongst vegetation by inserting the egg into a cavity on the plant or inside a hollow stem.

On hatching the eggs release a tiny *vermiform* (worm-like) larvae which soon sheds its skin and becomes the first nymphal instar, in each case looking already like a miniature grasshopper or bush-cricket, though totally wingless. They then progress through a series of moults, 4 in grasshoppers, 5 or 6 in most bush-crickets, though up to 9 in the Great Green Bush-Cricket and 8-11 in the true crickets.

As they progress through these nymphal instars the developing grasshoppers, crickets or bush-crickets look more and more like the adults, but only after the final moult are the full-length adult wings obtained. Interestingly these insects have the remarkable ability to regenerate a limb or antennae at the next moult should this become accidentally lost whilst a nymphal instar. Once the final moult is completed this facility is no longer available to them however.

Grasshoppers generally have a one year life cycle hatching the following spring or early summer, but several of the bush-crickets (Great Green, Wartbiter, Dark, Speckled, Bog and Roesel's) and also the Wood Cricket do not hatch until the *second* spring after the summer in which they were laid giving them a two year life cycle (Hartley and Warne (1972), Warne (1972)—quoted in Ragge (1973)). There could thus presumably be even-year and odd-year populations, but it seems unlikely that this pattern will be entirely rigid with probably some hatching after one year and perhaps some after three. This system may thus act as an insurance mechanism to ensure survival over one adverse season.

COLOUR VARIATION

One of the first things you notice when you start to look closely at grasshoppers is that they seem to come in a bewildering variety of colours and patterns—green, brown, black, brown with green sides, green with brown sides, buff, mottled and even bright reddish-purple. Unfortunately colouration is not terribly helpful when trying to identify species; the Common Field Grasshopper for example has at least a dozen or more recognisable colour varieties and all these can be found alongside one another in the same colony. The Mottled Grasshopper is similarly variable, but in some species, like the Woodland Grasshopper or Rufous Grasshopper only a few colour variations occur.

Bush-crickets generally show far less colour variability than grasshoppers and what variation there is usually comprises a continuous range of differences in shade rather than distinct colour varieties. The Dark Bush Cricket, for example, varies in it's general colouration from pale olive or greyish brown through to almost black, the female usually being somewhat paler than the male. The true crickets seem to show very little colour variation at all.

In a colony of grasshoppers usually certain colour varieties are far more numerous than others and certainly in the Common Field Grasshopper at least there is definite tendency for the most common colour variety in a particular habitat to be that which most closely matches the background colour of the habitat (Gil 1979).

Richards and Waloff (1954) considered that all of the colour varieties of the Meadow Grasshopper are difficult to see in the natural setting as long as they sit still, but are conspicuous as soon as they move. Even the bright reddish-purple colour varieties find their match in the blotching on the leaves of Sheep's Sorrel *Rumex acetosella*.

Direct comparison of colour varieties between species is difficult, but for example it is certainly notable that the green colour variety, so frequent in Common Green, Meadow and Lesser Marsh Grasshoppers, is extremely rare in the Common Field Grasshopper. This latter species has a preference for dry habitats and will tolerate open stony situations or even losse sand. It is seldom found in damp situations or where the grass is lush and green whereas these are the preferred conditions for the other three species.

If this colour variation were purely under genetic control and the frequencies of the colour varieties in a particular colony relatively constant from year to year (Richards and Waloff 1954) this might suggest some form of multiple polymorphism maintained by selection. In a number of grasshopper species however colouration can be changed by alterations in environmental factors such as temperature and humidity (Rowell and Cannis 1971) and may even change in individual insects when moved to another background colour (Burtt 1951). This whole subject of colouration in grasshoppers and its ecological relevance is a fascinating one and still poorly understood, providing plenty of opportunities for further research.

SPECIES INDENTIFICATION

So, if colour is not much help, how do you set about identifying a particular Orthopteran you find?

Well—narrow it down to a family level and you are more than half way there. The British bush-cricket and true cricket species are all fairly distinctive and shouldn't present too many identification problems given access to either Ragge (1965), Brown (1983) or Chinery (1986).

The only tricky group then are the grasshoppers and groundhoppers, but even these can be readily mastered with a little care and practice. It is useful to determine the sex of a particular individual grasshopper to aid identification. The males have a smooth rounded shape to the tip of the abdomen, upturned like the prow of a boat whereas in the female it appears toothed, the "teeth" being the valves of the ovipositer. In general however it is often not necessary to get down to this sort of detail—male grasshoppers are usually smaller than the females of the same species but have proportionally larger antennae and this difference in proportions is usually readily apparent (see Plate 3 of Lesser Marsh Grasshopper male and female).

The shape and pattern of ridges and keels on the pronotum is one of the most useful characters in grasshoppers since this pattern varies markedly between species, as can be seen by reference to Fig 1 (after Ragge 1965). In the groundhoppers it is mainly the shape and length of the backward projecting spine of the pronotum which aids specific identification. However, Cepero's and

Slender Groundhoppers are difficult to separate and since this can only be reliably done by careful measurements, immediate identification in the field is not normally possible.

Amongst the grasshoppers characters such as wing length and structure of the antennae are useful for identifying certain species. For example, only two British grasshopper species have clubbed antennae —in the Rufous Grasshopper these have obvious white tips (see Plate 4), in the Mottled Grasshopper they do not. Only the female Meadow Grasshopper (Plate 5) has wings so short it is unable to fly (but beware nymphal stages of other species!); so short wings combined with parallel keels on the pronotum clinch this identification, for the normal form of the species. However nature seldom stands still and this is as true of grasshoppers as anything else; recently relatively large numbers of the hitherto fully-winged form of the Meadow Grasshopper (*Ch. parallelus f.explicatus*) have been found in several localities and these might be confused with specimens of Lesser Marsh Grasshopper, so it is worth checking carefully if these are plain looking fully-winged specimens in places where the Meadow Grasshopper is very numerous.

I mention this not to confuse, but simply to emphasise the need for careful study. These kinds of characters might sound a bit difficult at first, but actually it is surprising how quickly you can "get your eye in". Ears are useful as well as all the Orthoptera species have their own distinctive songs and it is an interesting and challenging exercise sorting them one from another. Habitat distinctions are also helpful and some scarcer species have a very restricted range.

ORTHOPTERA HABITATS AND DISTRIBUTION IN DEVON

In Devon 20 of the 28 native British species have so far been recorded making it amongst the richest of counties for its Orthoptera fauna. Orthoptera are essentially warmth-loving insects, so Devon's southern latitude greatly favours them.

The Mole Cricket sadly has not been recorded in recent times but all the other 19 species still occur and one or two others may yet remain to be discovered.

OAK BUSH-CRICKET *Meconema thalassinum*

This species inhabits trees, but is almost entirely carnivorous feeding on caterpillars, aphids and other insects; though favouring oak a number of other tree species as well as elder and hazel bushes in thickets and hedgerows are used and if searched for the Oak Bush Cricket could probably be found in most deciduous woodland areas and taller hedgerows in the county. It is likely that it is thus still much under-recorded in Devon and will prove to be widespread. Being largely nocturnal it is seldom seen in daylight unless disturbed, though it is frequently attracted to lights at night and often caught in moth traps.

GREAT GREEN BUSH-CRICKET *Tettigonia viridissima*

This dramatic beast (see Plate 6) is amongst the largest of British insects and it declares its presence during the afternoon and at night with its loud seemingly continuous trilling call. The unmistakable sound of this fine insect is

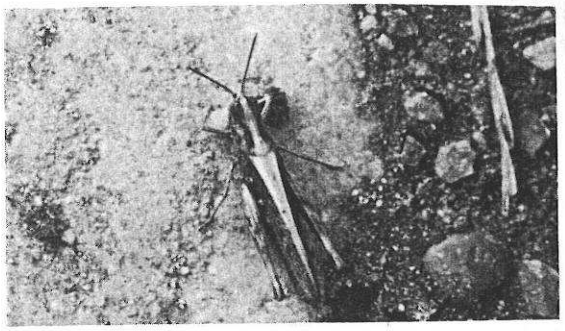

Plate 1: Common Field Grasshopper female

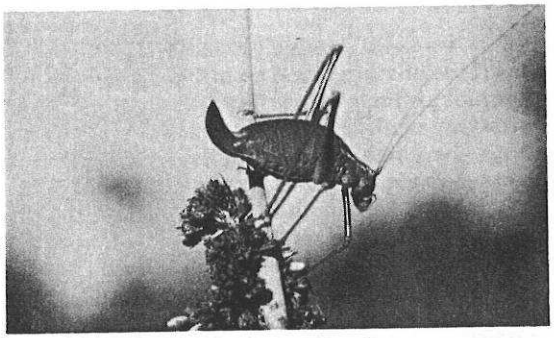

Plate 2: Speckled Bush-cricket female

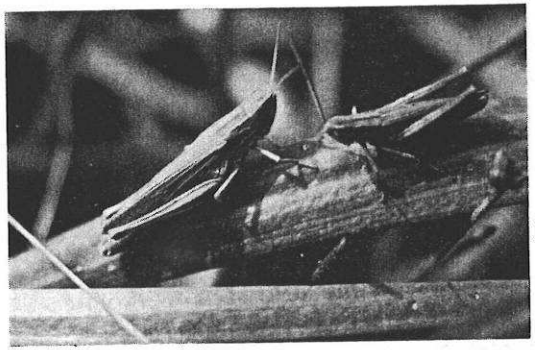

Plate 3: Lesser Marsh Grasshopper pair together (male on right)

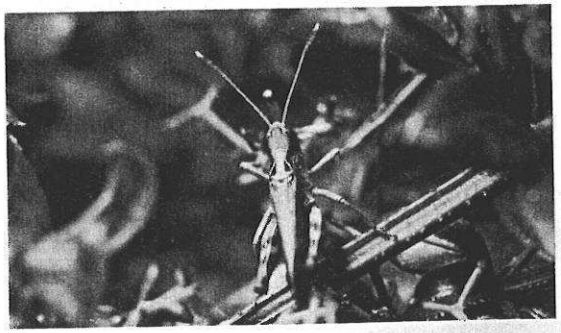

Plate 4: Rufous Grasshopper male

Plate 5: Meadow Grasshopper female

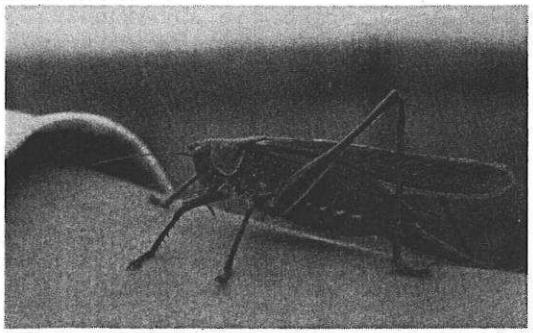

Plate 6: Great Green Bush-cricket female

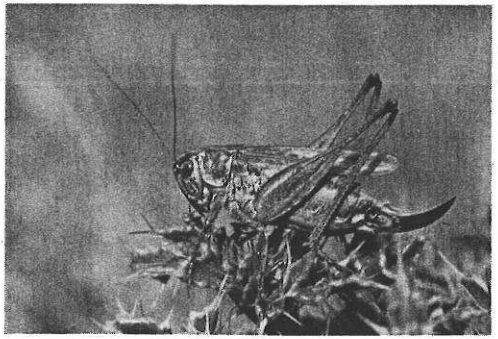

Plate 7: Grey Bush-cricket female

characteristic of the coastal areas of south and east Devon and the lanes of the South Hams, but there is also an isolated population along the north Devon coast.

It prefers areas of scrub and hedgerows, frequenting bramble thickets, or patches of reed or thistles —in fact almost any suitable scrubby vegetation, and it is frequently found in gardens in suitable warm sunny localities. Though easy to hear, its bright green colouration enables it to blend into the background remarkably well and seeing calling insects is by no means as easy as one might imagine especially as they seem to be able to sense your approach and stop calling as soon as you get near!

DARK BUSH-CRICKET *Pholidoptera griseoaptera*

This is undoubtedly the commonest and most widespread of all the bush-crickets in Devon, and indeed in southern England generally, perhaps a reflection of its

fairly catholic habitat preferences. Any kind of scrubby vegetation seems acceptable, though nettles and brambles are particular favourites. This is the common bush-cricket of the hedgerows and Devon banks; its short chirping call is a characteristic sound throughout the autumn months (July-October) in much of the county; calling especially during late afternoon, evening and much of the night.

It is absent from the high moors and other open ground, but otherwise occurs wherever there is enough growth of low shrubs. It's almost complete lack of wings (hind wings absent, and forewings reduced to small overlapping flaps in the male, vestigial in the female) give it a rather spider-like appearance, enhanced by its habit of scuttling off down into the bottom of the bush when disturbed.

GREY BUSH-CRICKET *Playtcleis albopunctata*

Although widespread along the entire south coast of England, this bush-cricket seems largely confined to south-facing slopes within a few hundred yards of the sea—in fact it's difficult to imagine how it could have a more southerly distribution in this country if it tried! Those parts of the cliff where vegetation has been able to establish itself are the preferred areas, mainly in low scrubby vegetation and herbs on dryish sites, like the gorse and rock strewn slopes above the beach on the undercliff east of Sidmouth to Beer Head.

It occurs commonly and is widespread along the east and south Devon coasts; though noted from only one area on the north Devon coast, it is also found in several other sites on both the Welsh and English sides of the Bristol Channel so perhaps may prove to occur elsewhere in North Devon.

BOG BUSH-CRICKET *Metrioptera brachyptera*

As it's name suggests this attractive bush-cricket inhabits mainly wet and boggy ground on lowland heaths and moors, a typical locality being the valley bog systems of the east Devon pebblebed commons or in the Heathfield area around Chudleigh Knighton, (Haes 1983). Its distribution thus tends to be concentrated

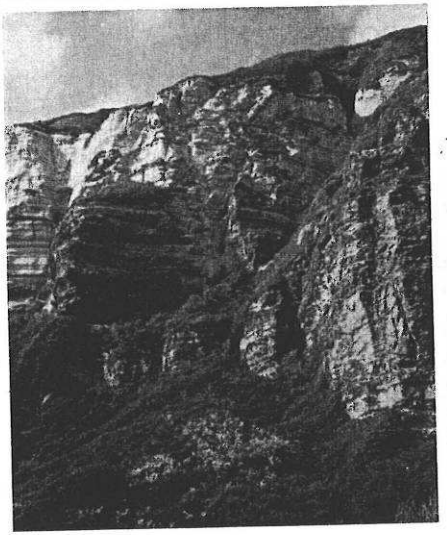

Plate 8: Branscombe Cliffs—home to some characteristically coastal species like Grey Bush-cricket, chalk-loving species like Rufous Grasshopper, but also abundant Great Green and Dark Bush-crickets, Common Field and Meadow Grasshoppers.

in the south-eastern part of the county, though it does live elsewhere where suitable wet heathland occurs. On these heathland area or in heathy woodland clearings, as on the Devon/Cornwall border, the more lush vegetation is preferred, but it is worth looking out for wherever the Cross-leaved Heath *Erica tetralix* predominates, this being generally indicative of damper areas. The gentle "chuffing" call of "BBC's" can be heard anytime from July through to October and unlike most of the other British bush-crickets this species is largely diurnal being particularly active and noisy on warm sunny summer afternoons.

SHORT-WINGED CONE-HEAD *Conocephalus dorsalis*

This slender but elegant bush-cricket inhabits rushes, sedges and reeds and tends to prefer areas on or near saltmarshes. Hence its distribution in Devon is largely coastal and linked to the location of the main estuarine systems. Its thin wheezing call is so high in frequency as to be near the audible threshold for some people, and thus it may be overlooked. When disturbed it moves easily around amongst the rush stems, but when still it can be remarkably difficult to spot, its long gangly hind legs, slender green body and ridiculously long antennae (see Plate 10) blending in perfectly with the background.

SPECKLED BUSH-CRICKET *Leptophyes punctatissima*

This bizarre creature (see Plate 2) is readily identified by the minute spotting which seems to cover every part of its body. It occurs in dry shrubby areas and open woodland where the adult is frequently found in trees, particularly birch.

Bramble and gorse are other favoured habitats and it thus has a relatively widespread distribution in Devon. The occurrence of the Speckled Bush-Cricket on Lundy is interesting however, since having only tiny vestigal wings it is quite unable to fly.

Its call is brief, almost beyond human hearing and easily missed, and when disturbed it tends to hop or scramble away down into the vegetation out of sight. It is probably thus overlooked and more widespread in the county than the map suggests.

WOOD CRICKET *Nemobius sylvestris*

The Wood Cricket has a very restricted distribution in Britain confined largely to two areas—around the New Forest and Isle of Wight, and here in East Devon. It has been suggested (Haes 1979) that it's presence at all in Britain may be as a result of accidental introductions on the roots of imported forest trees in the last century, but where it occurs it is certainly now well established, and was certainly already present in Devon by 1880 (Parfitt 1882).

In Devon there are recent records from various parts of the east Devon commons, around Aylesbeare, Harpford and East Budleigh and from the DTNC Reserve at Dunsford Woods, but thorough searching may well turn it up in other sites.

Wood Crickets are normally found amongst leaf litter and other ground layer material beneath trees in woodland, or along rides or the woodlands edge and are most likely to be located by their faint chirping song. At first this sound seems scarcely noticeable, but once heard it is actually very distinctive and can be readily detected.

Plate 9: Aylesbeare and Harpford Common, East Devon —a rich hunting grounds for Orthoptera species notably Bog Bush-cricket and Wood Cricket but also Common Field, Common Green, Medow and Mottled Grasshoppers, Dark and Speckled Bush-crickets and Common Groundhopper.

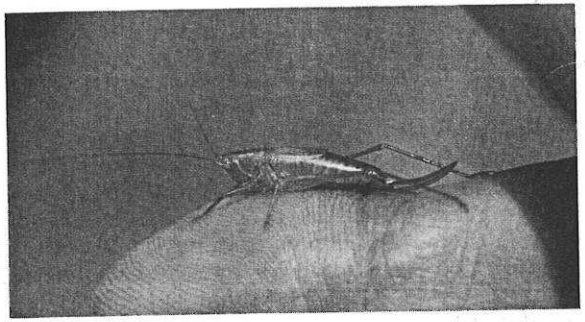

Plate 10: Short-winged Cone-head female

Plate 11: Wood Cricket female

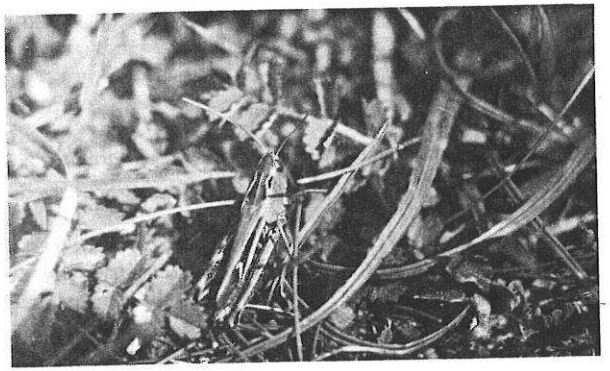

Plate 12: Stripe-winged Grasshopper female

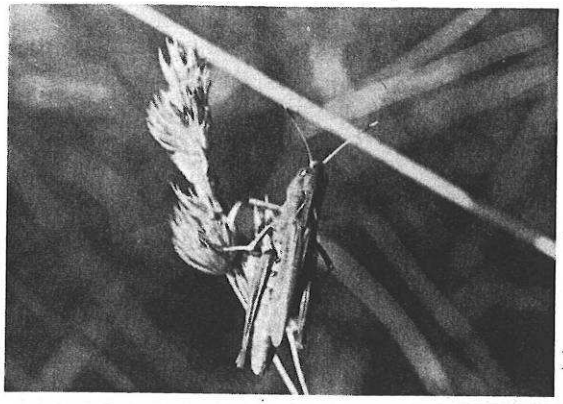

Plate 13: Rufous Grasshopper —female

HOUSE-CRICKET *Acheta domestica*

This introduced species of true cricket, was once common and widespread in Devon, and Parfitt (1882) reported it as "abundant in bakehouses and kitchens in almost every town". In recent years it seems to have become much scarcer, though there were records from papermills in Ivybridge in the late 1960's and rubbish tips in neighbouring counties have established colonies. (per Royal Albert Museum Biological Data Bank).

MOLE-CRICKET *Grylloptalpa gryllotalpa*

Parfitt (1882) noted that "This fine insect occurs rather frequently in meadows in the neighbourhood of Exeter. A few years ago several were brought to me; they were found in the streets of Exeter early in the morning. My impression is that in flying over the city in the night they had stuck against the chimneys, and fallen down into the streets".

Certainly if such an event occurred today, we would be likely to hear about it, as the Mole-Cricket is a dramatic looking insect by anyone's standards—the extraordinary enlarged forelegs which are used in digging its underground burrows are remarkably reminiscent of the forelimbs of a mole, hence its name. An inhabitant of moist areas, particularly flood meadows and damp pasture, the Mole-Cricket attracts attention by the loud continuous trilling song produced by the male in the entrance to the burrow.

Sadly there have been no recent records of Mole-Crickets in Devon; it has declined dramatically throughout its former range in southern England and is now known from only two colonies in Hampshire and Wiltshire, but with records of isolated individuals in Cheshire and East Sussex (Haes 1979).

CEPERO'S GROUND-HOPPER *Tetrix ceperoi*

This is a scarce and local species in Britain, recorded from only a scattering of coastal localities from Sussex to Cornwall and South Wales. In Devon it is largely confined to the east Devon coast and one site in the north, the two records on the western boundary actually being from the Cornish coast in these 10 km squares.

Though coastal, this species generally prefers the vicinity of damp, largely freshwater areas, ponds and wet flushes on cliffs or alongside rivers, and like the other groundhoppers can actually swim quite well, even below the surface.

SLENDER GROUND-HOPPER *Tetrix subulata*

Though closely related to Cepero's Ground-hopper, the Slender Ground-hopper is much more widespread in southen parts of the county, occurring at both inland and coastal localities. It also prefers moist localities near streams and ponds, damp meadows, wet dune slacks and I have even recorded it on the edge of an area of wet heath on the east Devon Commons. It can swim well and in warm sunny conditions will often take flight for several metres. Like the other groundhoppers, it does not seem to produce any audible sounds.

COMMON GROUND-HOPPER *Tetrix undulata*

By far the commonest of our three ground-hoppers, this species is widespread throughout the southern and eastern part of the county but is recorded from the north and is probably much overlooked elsewhere. Ground-hoppers do literally live on the ground below the vegetation and their small size and cryptic colouration combined with their lack of an audible song mean that they tend only to be noticed if they move.

The Common Ground-hopper prefers drier habitats than the other two British species and can be found in a variety of locations from the edges of woodland rides, open clearings, and even areas of dryish dune slacks such as at Dawlish Warren or on dry heathland like the east Devon pebblebed commons.

STRIPE-WINGED GRASSHOPPER *Stenobothrus lineatus*

This species is typical of dry calcareous grasslands and its distribution in southern England shows a strong association with the outcrops of chalk and limestone. Strangely enough however, it has not been recorded from the east Devon chalk or Torbay limestone but would be worth searching for there. Elsewhere it also occurs in the sandy soils of the Breckland in East Anglia, and it is on soils related to this type that it has been locally recorded in Devon, on the east Devon pebblebed commons and sand dune systems in the north.

It's thin wheezing call and strikingly green colouration with a prominent white line (*linea scapularis*) along the side of the pronotum and leading edge of the forewing in the larger female, and a white "comma" on the forewing of both sexes make this a distinctive species, though well camouflaged so it is not always that easy to see.

WOODLAND GRASSHOPPER *Omocestus rufipes*

This is another local species in Devon recorded only from two areas in the south-east of the county though with a few older records from the north and south. It tends to be a rather local species generally in Britain and is largely confined to counties south of a line from the Thames across to the Severn.

It's preferred habitat is in the vicinity of trees and it will even occur in quite shaded situations in woodland rides and clearings unlike the other British grasshopper species. The edges of woods with heath or grassy areas or even bracken are frequent locations, but Ragge (1965) noted that in the West Country it may sometimes be found in more open situations.

It's stridulation is similar to that of the next species, from which however it may always be separated by red on the abdomen in mature specimens and especially by the chalk-white palps near the mouth parts, the pure white palps are diagnostic, if they are brownish or even dirty white it is *not* a Woodland Grasshopper.

COMMON GREEN GRASSHOPPER *Omocestus viridulus*

The Common Green Grasshopper is indeed an abundant and widely distributed species in Devon though certainly not so ubiquitous as the other two commonest species, the Common Field and Meadow Grasshopper. It tends to prefer damp situations or at least those where there is a reasonably rich growth of grass, giving a generally green background colour to the habitat. It tends to be the commonest species in the upland parts of Devon and occurs widely on grass moorland on Dartmoor and Exmoor and lower down on heathland and woodland edge.

MOTLED GRASSHOPPER *Myrmeliotettix maculatus*

This is the smallest of our common grasshoppers and is easily distinguished by its clubbed antennae (lacking a white tip) and sharply inflexed keels on the pronotum (see Figure 1). It is fairly widespread and common in parts of Devon occuring mainly in dry heathland or moorland situations. It also occurs in well vegetated dune slacks, (as in north Devon) but here as elsewhere it tends to prefer areas where the vegetation is relatively short. On the east Devon commons, for example, it can be found commonly on areas of heath and grass heath a year or two after they have been burnt. It's song has a buzzing quality but is intermittent and a number of complicated patterns have been recorded as part of the courtship sequence.

RUFOUS GRASSHOPPER *Gomphocerippus rufus*

This very distinctive grasshopper with it's white-tipped clubbed antennae (see Plate 4) is strictly a denizen of calcareous grassland , its distribution in Britain being virtually confined to the North and South Downs, the Cotswolds, the Mendips and here on the east Devon chalk. Though there are a few pre-1960 records in other parts of the county, recent records of this species are confined to the coastal chalk grasslands from Dunscombe east to Beer Head and Seaton along the clifftops and undercliff. (Haes 1983). The Rufous Grasshopper occurs on unimproved chalk grassland swards containing typical species like Salad Burnet *Poterium sanguisorba* and Stemless Thistle *Cirsium acaule*. Though mostly it shows little variation from its basically brown colouration there is a "purple" colour variety which is very striking (see front cover). The courtship "dance" of the male is fascinating to watch.

LESSER MARSH GRASSHOPPER *Chorhippus albomarginatus*

This is essentially a species of coastal reclaimed marshes and similar grassland types but it occurs commonly inland throughout the Lincolnshire and Cambridgeshire Fen country. In Devon the only recent records are from the grazing marshes along and around the Exe Estuary, principally on the west side around Exminster and Powderham. Since this is the only extensive area of this type in the county it may be that it is confined to this part of the Exe valley, but further searching may reveal its presence in smaller pockets of such habitat adjacent to one or two of the smaller Devon estuaries.

COMMON FIELD GRASSHOPPER *Chorthippus brunneus*

Along with the next species this is the commonest and most widespread of all the grasshoppers in Devon and indeed in Britain generally. It occurs in a wide variety of habitats from roadside verges, woodland rides, heathland edge, sand

dune slacks etc, but these always tend to be relatively dry sites. Rough grassland with an abundance of annual weeds is often frequented and the numerous colour varieties and patterns exhibited by the species presumably help it to blend in with its background in these varied habitats.

It is easily distinguished by its long wings (it is a quite reasonable flier over short distances) sharply inflexed keels on the pronotum (see Plate 1 and Figure 1) and strong orange-red colouration on the upper part of the abdomen tip in the mature male and to a lesser extent in the female, although this is never as bright as is often the case with the local Woodland or Stripe-winged Grasshoppers.

MEADOW GRASSHOPPER *Chorthippus parallelus*

This is a very common and widespread species throughout Devon and Britain generally, occurring in a wide range of grassland situations but always tending towards moist or at least damp situations. Thus roadside verges, woodland fringes, moorland, wet heaths, lowland marshes and meadows all provide suitable habitats. It is easily distinguished by the short wings—much shorter than the abdomen in the male and vestigial in the female, (which is thus flightless) combined with the parallel keels on the pronotum (hence its scientific name). It comes in a selection of colour varieties, though it is by no means as variable as Common Field Grasshopper and unlike that species frequently includes some green colouration. The males and most females also have distinctly blackish "knees" to the hind legs. This also applies to the scarce long-winged form (see above) which were it not for the black knees, might easily be mistaken for a Lesser Marsh Grasshopper.

Twenty out of the 28 native species of Orthoptera have been recorded in Devon, and of the remaining 8 only one or two can be considered as possible additions.

Rarities like the Wartbiter and Field Cricket are restricted to a handful of British localities and along with the Mole Cricket now have only a tenuous foothold in this country. The Scaly Cricket is known only in a single locality in Dorset and the Lesser Mottled Grasshopper only from the Isle of Man. The Heath Grasshopper seems confined to areas of dry heath in Purbeck and the New Forest and the Large Marsh Grasshopper to quaking bogs in these same two areas plus the Somerset levels and Western Ireland. Roesel's Bush Cricket is found mainly around the grazing marshes of the Thames Estuary but also occurs in several outlying sites in Wales, Humberside, and Hampshire and might possibly be discovered elsewhere including Devon? The Long-winged Cone-head seems to have undergone something of a range expansion in recent years (Haes 1984) particularly in the New Forest and parts of Purbeck and could perhaps one day turn up on an east Devon saltmarsh, valley bog or chalk downland area.

ACKNOWLEDGEMENTS

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REFERENCES

BROWN, V.K. (1983). **Grasshoppers**. Cambridge University Press — Naturalists' Handbook 2. Cambridge, 65pp.

BURR, M. (1936). **British Grasshoppers and their Allies**. Janson. London. 162pp.

BURTT, E. (1951). The ability of adult grasshoppers to change colour on burnt ground. **Proceedings of the Royal Entomological Society of London**. Series A, 26, 45-8.

CHINERY, M. (1986). **Collins Guide to the Insects of Britain and Western Europe**. Collins. London. 320pp.

GILL, P.D. (1979). Colour-pattern variation in relation to habitat in the grasshopper *Chorthippus brunneus* (Thunberg). **Ecological Entomology**. 4, 249-57.

HAES, E.C.M. (1973). **Crickets and Grasshoppers of the British Isles**. British Naturalists' Association.

HAES, E.C.M. (1979). **Provisional Atlas of the Insects of the British Isles Part 6, Orthoptera1 (second edition).** Institute of Terrestrial Ecology. Huntingdon.

HAES, E.C.M. (1982). **Orthoptera Recording Scheme**. Newsletter No. 8.

HAES, E.C.M. (1983). **Orthoptera Recording Scheme**. Newsletter No. 9.

HAES, E.C.M. (1984). An apparent expansion of the known range of *Conocephalus discolor* (Thunberg) (*Orthoptera:Tettigoniidae*) into the New Forest and heathlands of east Dorset. **Entomologist's Gazette**. 35, 64-65.

HARTLEY, J.C. AND WARNE, A.C. (1972). The developmental biology of the egg stage of Western European Tettigoniidae (Orthoptera). **J. Zool**. London. 168, 267-298, one figure.

LUCAS, W.J. (1920). **A monograph of the British Orthoptera**. xii and 264pp; 25 figs, 25 pls. London.

MARSHALL, J.A. AND HAES E.C.M. (1987/8). **Grasshopper and Allied Insects of Great Britain and Ireland**. Harley Books. (to be published in late 1987 or early 1988). Colour illust. by Dennis Ovenden; tape cassette of songs.

PARFITT, E. (1882). **The Fauna of Devon. Euplexoptera, Orthoptera and Homoptera**. Transactions. Devonshire Association. VXIV, 364-386.

PICKARD, B.C. (1954). **Grasshoppers and Crickets of Great Britain and the Channel Islands**. Ilkley: published by the author. 131pp.

RAGGE, D.R. (1965). **Grasshoppers, Crickets and Cockroaches of the British Isles**. Warne. Wayside and Woodland Series. London. 299pp.

RAGGE, D.R. (1973). The British Orthoptera: A Supplement. **Entomologists' Gazette**. 24, 227-245.

RICHARDS, O.W. AND WALOFF, N. (1954). Studies on the Biology and Population dynamics of British grasshoppers. **Anti-Locust Bulletin**. 17, 182pp.

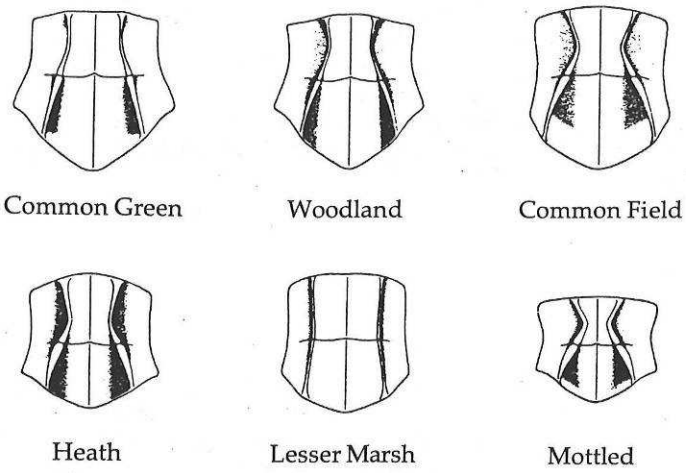
ROWELL, C.H.F. AND CANNIS, T.L. (1971). Environmental factors effecting the green/brown polymorphism in the cyrtacanthacridine grasshopper *Schistocerca vaga* (Scudder). **Acrida** 1, 69-77.

WARNE, A.C. (1972). Embryonic development and the systematics of the Tettigoniidae (*Orthoptera; Saltatoria*). **Int.J. Insect Morph. Embryol.** 1, 267-287, 6 figs.

Corrigenda

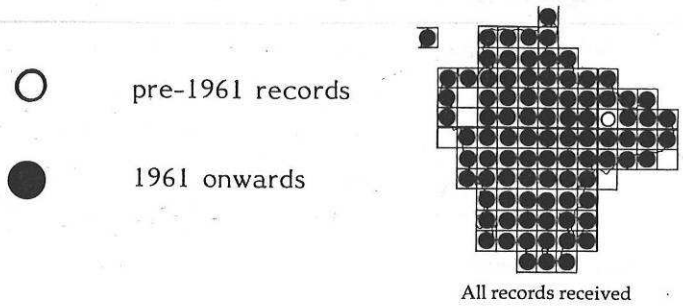
Page 64: For all species listed substitute the word Grasshopper for Ground-Hopper eg Stripe-winged Ground-Hopper becomes Stripe-winged Grasshopper

Figure 1: Dorsal view of the pronotum of various grasshopper species



(reproduced from Ragge (1965) with permission)

PROVISIONAL ATLAS OF ORTHOPTERA IN DEVON



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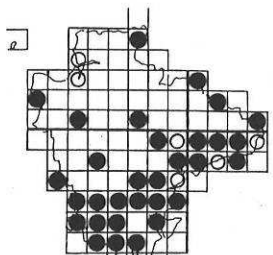
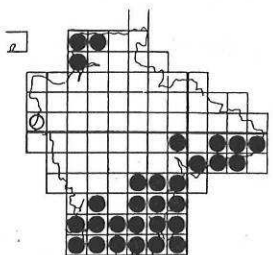
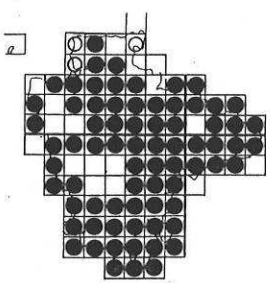


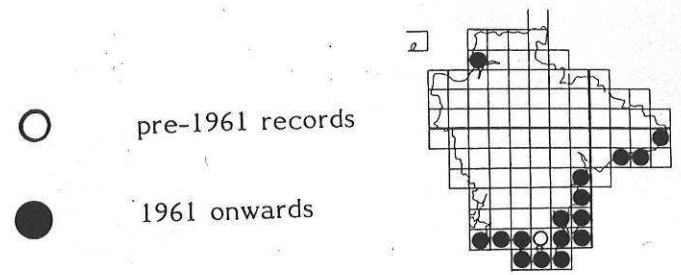
Oak Bush Cricket
(*Meconema thalassinum*)



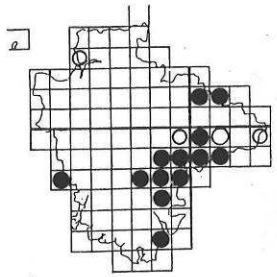
Great Green Bush Cricket
(*Tettigonia viridissima*)



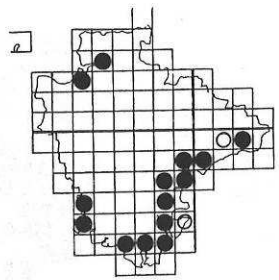
Dark Bush Cricket
(*Pholidoptera griseoaptera*)



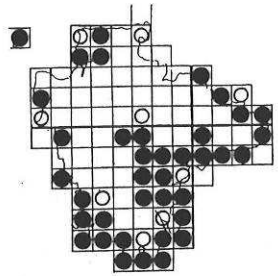
Grey Bush Cricket
(*Platycleis albopuntata*)



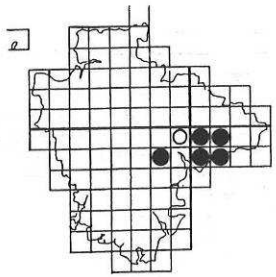
Bog Bush Cricket
(*Metrioptera brachyptera*)



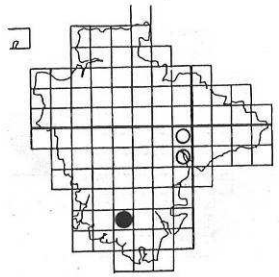
Short-winged Conehead
(*Conocephalus dorsalis*)



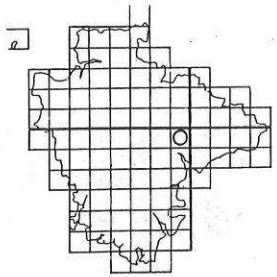
Speckled Bush Cricket
(*Leptophyes punctatissima*)



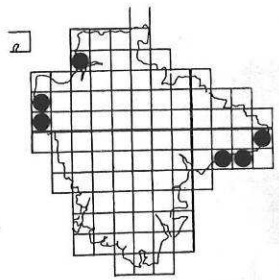
Wood Cricket
(*Nemobius sylvestris*)



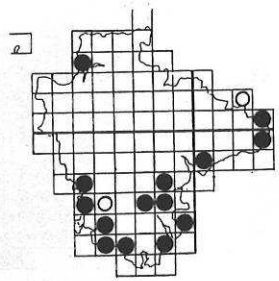
House Cricket
(*Acheta domestica*)



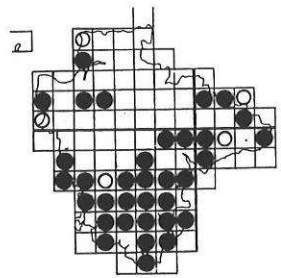
Mole Cricket
(*Gryllotalpa gryllotalpa*)



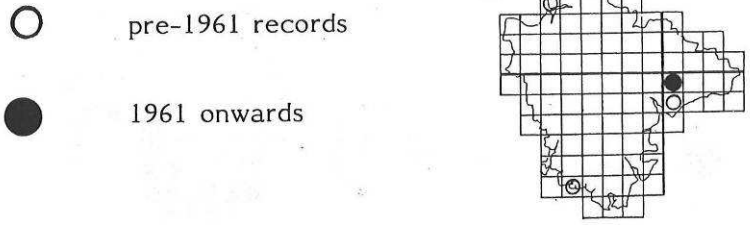
Cepero's Ground-hopper
(*Tetrix ceperoi*)

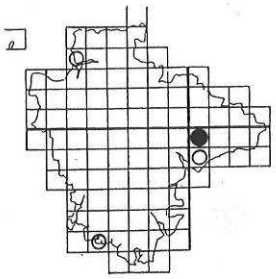


Slender Ground-hopper
(*Tetrix cubulata*)

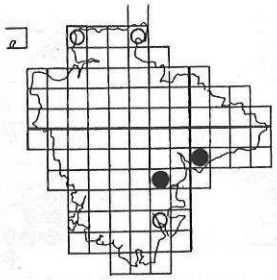


Common Ground-hopper
(*Tetrix undulata*)

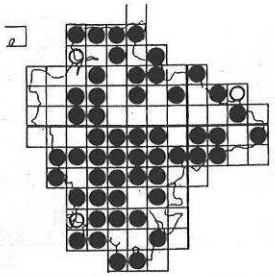




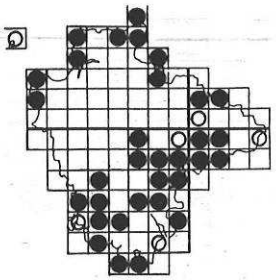
Stripe-winged Ground-hopper
(*Stenhobothrus lineatus*)



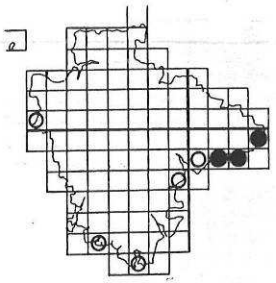
Woodland Ground-hopper
(*Omocestus rufus*)



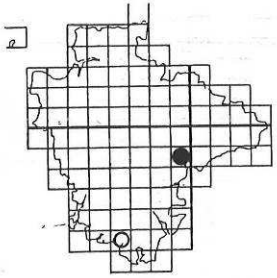
Common Green Ground-hopper
(*Omocestus viridulus*)



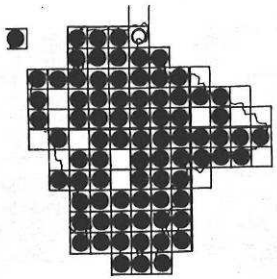
Mottled Ground-hopper
(*Myrmeliotettix maculatus*)



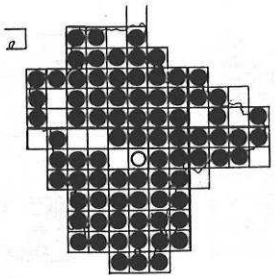
Rufous Ground-hopper
(*Gomphocerippus rufus*)



Lesser Marsh Ground-hopper
(*Chorthippus albomarginatus*)



Common field Ground-hopper
(*Chorthippus brunneus*)



Meadow Ground-hopper
(*Chorthippus parallelus*)