THE SEPARATION OF FEMALES OF BRITISH SPECIES OF *PANORPA* (MECOPTERA: PANORPIDAE)

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INTRODUCTION

The separation of females of British species of *Panorpa* has always presented problems to the entomologist. The existing key by Fraser (1959), whilst allowing for easy determination of the males, contains a printing error in the key to females. Furthermore, the characters used by Fraser are difficult to discern in many specimens and are unusable on insects which are not preserved in a fluid medium.

In addition, experience has shown that the shapes and relative lengths of the abdominal segments of female *Panorpa* species are far from constant. In teneral and pre-gravid animals the abdominal segments naturally overlap, with the more posterior ones inserting into their anterior neighbours. During gravidity, the distention of the abdomen causes the posterior segments to slide backwards so that a greater length of each segment is visible externally. This, inevitably, affects the relative lengths of the segments—the character upon which Fraser relied. Similar, more artificial, distortions occur in some fluid-preserved specimens whilst most pinned material contracts causing the segments to become more inserted than in life.

Hobby & Killington (1934) suggested that wing markings, venation and length of forewing may be used as criteria for determination. Recent experience, however, suggests that all three of these characters are too variable within the British fauna to be of use, even as confirmatory characters. To deal with these characters in reverse order, the unreliability of forewing length is demonstrated in Table 1 which shows a clear overlap of the lengths for all three species. The use of wing venation in such a variable group is fraught with difficulties. Hobby & Killington (1934) stated that the anterior arm of vein R_s in the forewing *normally* bears four branches in *P. communis* L. and three branches in the remaining two species. Of the 342 *P. communis* that I have personally examined, 298 had four branches and 44 had three branches, whilst of 267 *P. germanica* L. 19 had four branches to this vein. All of the *P. cognata* Rambur examined had three branches, however; this agrees with the conclusions of Hobby & Killington, though the present results are based on a sample of only 19 specimens. On the matter of wing patterning, the only constancy which I have been able to discover rests in the Scottish f. *borealis* Steph. of *P. germanica* which is always devoid of any markings. In general, the more boldly marked female specimens in which the apical black spot extends forwards around the wing tip and along the costa are *P. communis*. However, I have seen this character in nine examples of *P. germanica*

Table 1. Comparison of results of forewing measurements of British *Panorpa* species between the present study and Hobby & Killington (1934). The size of Hobby & Killington's samples are not clear from the results, nor is it known whether the measurements involved males, females or both. The sample sizes (*n*) used to obtain the present results are indicated. All of the examples used in the present survey were females and the samples include both dried and fluid preserved specimens.

	Length of forewing		
	P. cognata	P. communis	P. germanica
Hobby & Killington	12.5–14.0 mm	13.5–15 mm	11.5–13.0 mm
present study	12.0–13.5 mm ($n = 19$)	11.0–15.0 mm ($n = 342$)	11.0–14.0 mm ($n = 267$)

(though never in *P. cognata*). It is even less reliable to assume that the reverse is true, for whilst in most female *P. germanica* the apical spot is confined to the apex of the wing, this is also the case in a large number of female *P. communis*. The position of the pre-apical fascia, when present, is also variable. Hobby & Killington stated that in *P. communis* this runs from the pterostigma to the distal extremity of vein Cu_1, whilst it runs from the pterostigma to the distal extremity of vein M_4 in *P. germanica*. Although this is true in many cases, I have seen a number of examples of variation in females of both species. This fascia is quite often absent in any case. It is apparently always absent in *P. cognata*. The size, shape and position of all other wing patterning is extremely variable, particularly in *P. communis* and *P. germanica* and so is quite unreliable as a character for specific determination.

The wings of *P. cognata* are suffused brownish in the specimens I have examined, as indeed they are in the *borealis* form of *P. germanica*. In both *P. communis* and *P. germanica* females the wings are hyaline in all material seen by me.

Female genitalia

In many species of Lepidoptera, as well as other orders of insects, examination of the genitalia is the basis for critical determination. This method appears to have been overlooked by successive British mecopterists, however, and there seems to be only two papers in the British literature which refer to the genitalia. Ward (1979) discussed the structural variation of the male and female genitalia of species in the *P. alpina* complex, though none of the species within this complex are yet recorded as British. Later (Ward, 1983), he also discussed similar variations in the *P. cognata* complex, but although this paper provided six drawings of the female genital plate of *P. cognata* sensu stricto, none of the material illustrated was collected in Britain. Accordingly, I dissected and examined the genital plate of 19 examples of *P. cognata*, 342 *P. communis* and 267 *P. germanica*. Although there is some degree of variation within this structure, there does seem to be sufficient constancy to permit safe identification of the three species using this character alone. The opportunity is now taken, therefore, to illustrate the female genitalia of the three known British species of *Panorpa* and to provide a simple key for their separation.

Extraction and preservation of female genitalia

The abdomen should be detached with a pair of sharp scissors. It is not necessary to detach the entire abdomen but care should be taken to ensure that segments 7 onwards are with the detached section. This means, in practical terms, all of the darker coloured, narrow bit of the abdomen! The detached abdominal segments are then placed in 10% potassium hydroxide solution in a small glass tube and the tube is stood in a bowl of boiling water. The length of time that the specimen should be left varies from about 30 minutes in a fluid-preserved teneral specimen to 1.5 hours in a shrivelled and dried pinned specimen. The temperature of the water bath should be maintained throughout by regular replacement from the kettle. (With fluid-preserved specimens my personal preference is not to detach the abdomen but to digest the entire insect in the potassium hydroxide solution. The genitalia can then be later extracted but not detached, thus avoiding any possibility of loss in storage. However, if entire insects are treated this way then only the sclerotized parts remain and specimens are thus useless for internal anatomical studies.) The digested abdomen is then washed once in tap water and the genital plate should be clearly visible through the abdominal wall. Removal is effected by making an incision along the lateral

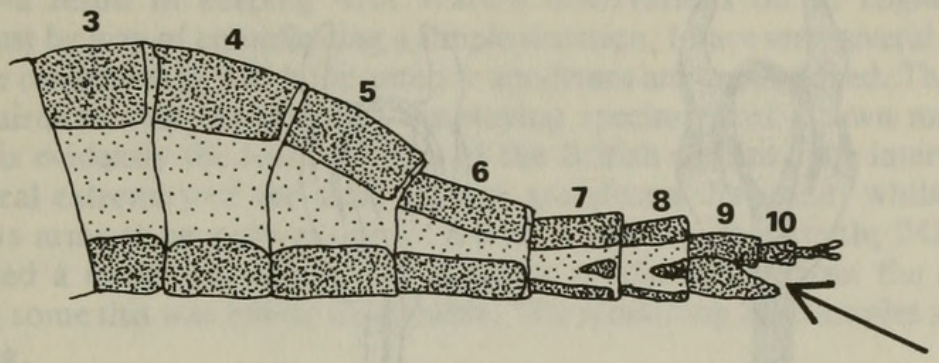


Fig. 1. Lateral view of abdomen of a female *Panorpa* species showing the position of the female genital opening between the ninth tergite and sternite.

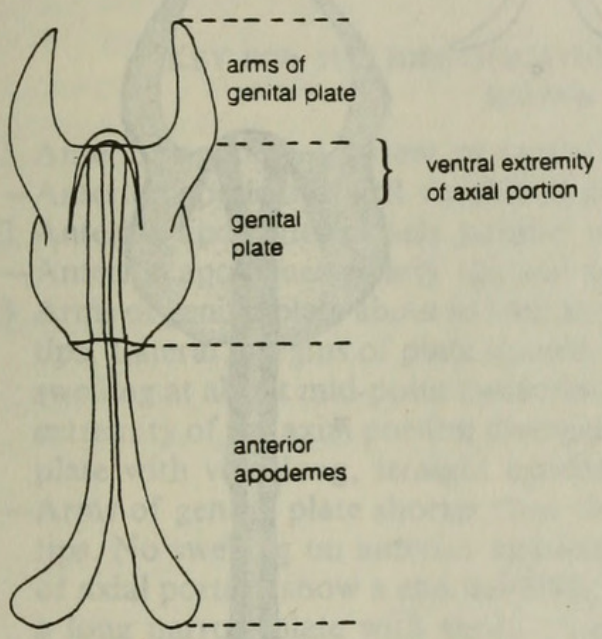


Fig. 2. Stylized drawing of the female genitalia of *Panorpa* indicating the terminology employed in the key.

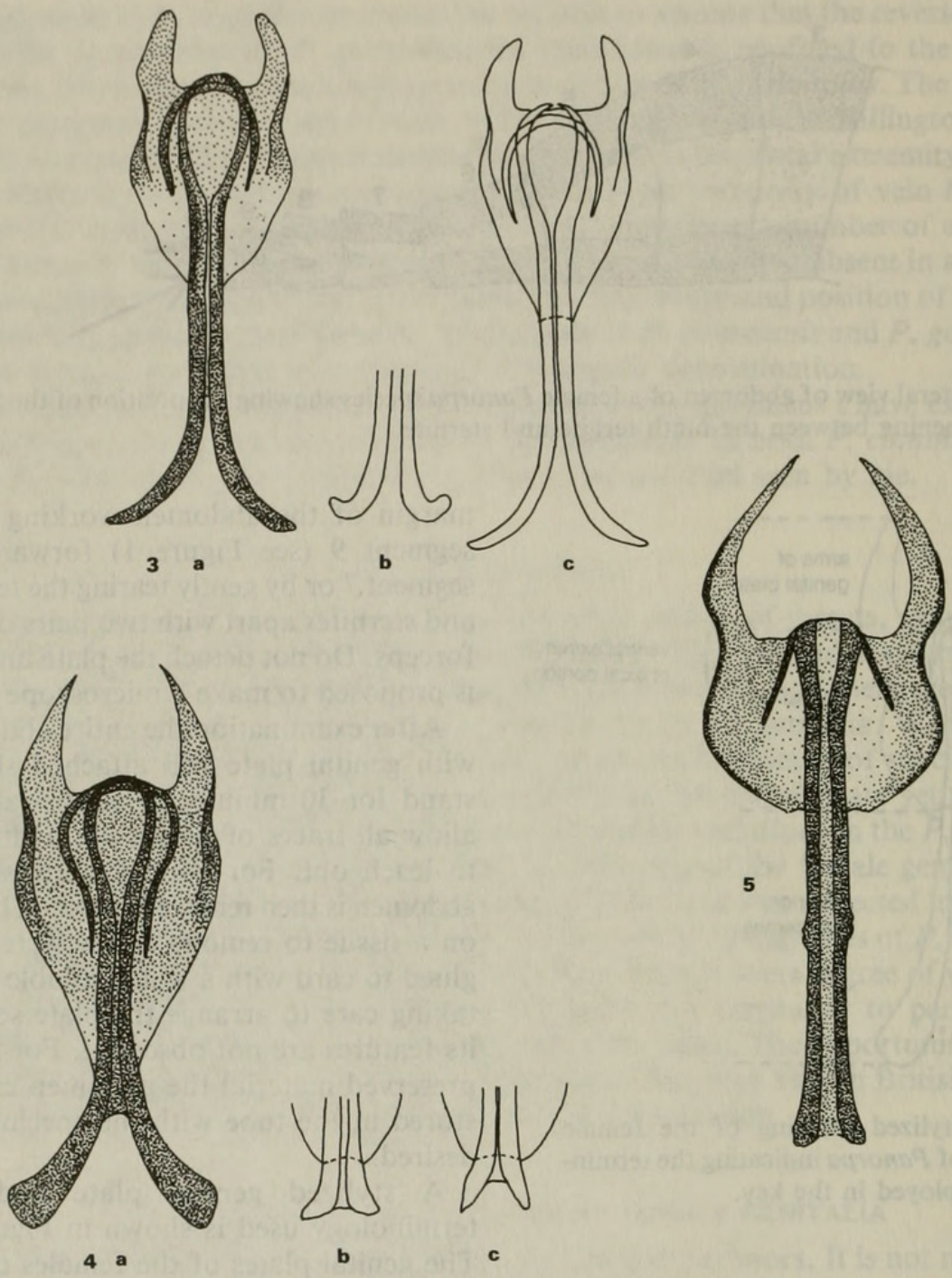
margin of the abdomen working from segment 9 (see Figure 1) forwards to segment 7 or by gently tearing the tergites and sternites apart with two pairs of fine forceps. Do not detach the plate unless it is proposed to make a microscope slide.

After examination the entire abdomen with genital plate still attached should stand for 30 minutes in clean water to allow all traces of potassium hydroxide to leach out. For pinned material, the abdomen is then removed, touched briefly on a tissue to remove excess water and glued to card with a water-soluble gum, taking care to arrange the plate so that its features are not obscured. For fluid-preserved material the abdomen can be stored in the tube with the specimen if desired.

A stylized genital plate and the terminology used is shown in Figure 2. The genital plates of the females of the British *Panorpa* species are shown in Figures 3 to 5.

Variation

Variation in the genitalia of female *P. cognata* has been discussed by Ward (1983) on the basis of specimens collected in France, Italy, USSR, Austria and Yugoslavia, though not in Britain. The genital plates examined varied in outline and in length, particularly in teneral examples in which the lateral extensions of the anterior apodemes were not always developed (i.e. the ends were not necessarily splayed). The few British specimens so far examined have demonstrated little variation and the two extremes of plate length are shown in Figure 3 (a and c). There seems to be a degree of constancy in the horseshoe shape of the lateral margins of the ventral extremity of the axial portion. This constancy is, however, rather lacking in the *P. communis* examined. These margins tend to converge towards the anterior end (269 examples—as in Figure 4a) but in the remaining 73 specimens the convergence was less marked and the



Figs 3–5. Dorsal aspect of female genitalia of British *Panorpa* species.

3. *P. cognata* Rambur (a, Folkestone, East Kent, 10.viii.1895, in J. C. Dale coll. at National Museum of Wales; b, tips of anterior apodemes of a second specimen, data the same as for a; c, Therfield Heath, Hertfordshire, 29.viii.1987, in author's collection.).

4. *P. communis* L. (a, Wyre Forest NNR, Worcestershire, 21.vii.1987; b, Teneral specimen—tips of anterior apodemes, Dunmow, North Essex, 17.v.1989; c, apparently mature specimen—tips of anterior apodemes, Bishop's Stortford, Hertfordshire, 18.v.1989). All in author's collection.

5. *P. germanica* L., Elsenham, North Essex, 18.v.1989, in author's collection.

margins are better described as being sub-parallel. There is evidently considerable variation in the form of the anterior apodemes of *P. communis* and this seems to depend on the maturity of the insect. Figure 4a represents a typical fully mature specimen, and Figures 4b and 4c show teneral examples. This clearly indicates a post-emergence development of the anterior apodemes to achieve the state shown in

Figure 4a—a result in keeping with Ward's observations on *P. cognata* above. However, just by way of complicating a simple situation, I have seen several apparently fully mature *communis* in which the anterior apodemes are undeveloped. This situation clearly requires further investigation employing specimens of known maturity. *P. germanica* is evidently the least variable of the British species. The lateral margins of the ventral extremity of the axial portion are always divergent, whilst the plate itself and its arms show only minor variation in outline and length; 243 examples demonstrated a rough swelling of the anterior apodemes at about the mid-point, although in some this was barely discernible. The remaining 24 examples seen lacked this swelling.

In spite of the variations observed in the sample, there seems to be sufficient constancy within each species to enable reliable determination. The following key is therefore presented.

Key for the identification of female *Panorpa* species known in Britain

1 Anterior apodemes absent or vestigial (Figs 4b, 4c) ..... *P. communis*
—Anterior apodemes well developed (Figs 3, 4a, 5) 2
2 Anterior apodemes closely parallel (Fig. 5) 3
—Anterior apodemes clearly splayed at their tips (Figs 3a, 4a) 4
3 Arms of genital plate about as long as the plate, narrow and with acutely pointed tips. Lateral margins of plate sinuate. Anterior apodemes usually with a rough swelling at about mid-point (sometimes absent). Lateral margins of the ventral extremity of the axial portion divergent. Overall impression is of a small square plate with very long, straight apodemes (Fig. 5) ..... *P. germanica*
—Arms of genital plate shorter than the plate and wider with blunt or rounded tips. No swelling on anterior apodemes. Lateral margins of ventral extremity of axial portion show a characteristic horse-shoe shape. Overall appearance of a long narrow plate with short, straight apodemes (Fig. 3) ..... *P. cognata* (teneral or damaged specimens)
4 Anterior apodemes short and flattened, or else very broad, diverging broadly throughout most or all of their length (Fig. 4a). Tips of arms of genital plate tapering to points ..... *P. communis*
—Anterior apodemes longer, and parallel for much of their length before the tips diverge 5
5 Tips of arms of genital plate rounded. Tips of anterior apodemes slender, usually rounded and only moderately flattened, and tapering (Figs 3a, 3c) ..... *P. cognata*
—Tips of arms of genital plate pointed. Anterior apodemes widening at the tips which are usually broadly flattened (Fig. 4a) ..... *P. communis*

Acknowledgements

I am grateful to Adrian Amsden at the National Museum of Wales and to Steven Judd at the Liverpool Museum for the loan of specimens and for permission to critically examine these. I am also grateful to Peter Barnard at the BM(NH) for his comments on my drawings and for assisting in the near fruitless search of the literature for published works on the female genitalia of the Panorpidae.

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BOOK REVIEWS

Cerambycidae of northern Asia, by A. I. Cherepanov, Leiden, E. J. Brill, 1990: vol. 1, 642 pages, hardback, 225 Dutch Guilders; vol. 2, parts 1 & 2, 292 & 354 pages, hardback, 270 Dutch Guilders; vol. 3, part 1, 300 pages, hardback, 120 Dutch Guilders.—These four books are the first parts of an English translation of Cherepanov's mammoth six-book Russian work *Usachi Severnoi Azii* originally published between 1979 and 1985 (volume 3 parts 2 and 3 remain to be published in English). Of the 270 species included in these four parts, almost every one is illustrated as an adult, and most have figures of larva and pupa also. The extensive accompanying text runs to about 4–5 pages for each species, plus keys, plus notes on the genera.

The overlap with a British fauna is not great, with 29 out of a possible 53 British species (up to the genus *Mesosa* in vol. 3, part 1), although several other Asian species are irregularly introduced into this country in timber. Nevertheless, the books contain much on the biology and ecology of the beetles of interest to coleopterists with horizons wider than national boundaries.

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The role of ground beetles in ecological and environmental studies edited by N. E. Stork, Andover, Intercept, 1990, 424 pages, hardback, £40.—These are the proceedings of the 7th European Carabidologists' Meeting, held at the Royal Entomological Society in September 1989. Section one considers evolution in carabid populations, from subcortical populations in Eucalyptus trees to leg colour variants of *Pterostichus madidus*. Section two covers the impact of carabids on crop pests, and the influence of non-specific pesticides. Section three addresses the relationship between carabid beetles and 'environmental quality', and is probably the section of greatest interest to British coleopterists interested in ecology, conservation and the possible use of carabids as 'indicator' species. Two particularly interesting chapters from this point of view are those by M. D. Eyre and M. L. Luff, which attempts to classify European grassland habitats using carabid indicators, and by S. P. Rushton *et al.*, which seeks to compare the effects of grassland management on various individual carabid species. Section four covers life histories, population studies, migration and feeding. The final section covers the shorter papers given at the conference as posters. For the amateur the book is highly specialist and expensive and really aimed at academics, but keen coleopterists may still find something of interest in its pages.

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