CHAPTER XXII.

Duplicity of appendages in Arthropoda.

That there should be such a thing as a limb double in the sense in which the following are double, has always seemed to me most strange. We know that a segment of an Annelid, or a vertebra, may be on one side of the body divided to form two segments or two vertebræ (as in No. 88 or No. 7) while on the other side of the middle line the segment is single. This is in keeping with all that we know of Division of parts in Linear Series. So might we suppose that a parapodium, or a rib, or perhaps a limb-bud might divide into two; but the two half-segments or half-vertebræ are in Succession to each other, and are not complementary images of each other as these double-limbs are.

That a parapodium may divide into two Successive parapodia is possible enough, though, apart from division of the segment bearing it, I know no clear case. But it may be stated at once that in Arthropods and Vertebrates such a phenomenon as the representation of one of the appendages by two identical appendages standing in Succession is unknown. No right arm is ever succeeded on the same side of the body by another arm properly formed as a right, and no Crustacean has two right legs in Succession, where one should be. The only cases at all approaching this state are those of *Macacus* No. 504 (*q. v.*), a case that must be interpreted with great hesitation; and of the Frogs described by Cavanna and by Kingsley, also doubtful cases (see Chapter XXIII).

But though such repetition is probably unknown and is perhaps against Nature, there are still these strange double-limbs: two limbs, always I believe imperfect, placed not in Succession, but as complementary images of each other, more or less exact. These we have seen in the hand of Man and in the feet of Artiodactyles; we have now to study them in Insects and in Crustacea[1].

[1] With mistrust I name cases in Amphibia and Fishes, perhaps of this nature. **Lissotriton punctatus** (Newt): left pes having 10 digits in two groups, 6 and 4. *Coll. Surg. Mus.*, *Ter. Ser.*, 293, A [not dissected]. **Protopterus annectens**: rt.

On the morphology or significance of duplicity in limbs I can make no comment beyond the few remarks given on p. 406. It is just possible that in Nos. 832 to 834 the duplicity of the chela or of the index is a division in the middle line of a Bilateral Minor Symmetry; for some chelæ are peripherally very nearly symmetrical about the plane of the dactylopodite and index.

In Arthropods double-limbs are no less rare than in Vertebrates, for though in various works there are some scores of cases to be found, the great majority may be safely rejected as being almost certainly cases of double extra parts in Secondary Symmetry having their duplicity disguised as we saw it in Nos. 750, 764, or 801. By most of those who have dealt with these things the possibility of disguised duplicity in the extra part has been unheeded; and ignorant of the special difficulties of these cases they have thus set down specimens as examples of duplicity of appendages at a casual glance. For this reason therefore I shall only give particulars of those few cases which are better established or otherwise of special interest, letting the rest follow as a list of references.

It will not be forgotten that whenever an extra part is in itself symmetrical it always *may* be a double structure, and the special application of this fact to cases of extra filamentous antennæ must in particular be borne in mind.

CRUSTACEA.

*831. **Hyas araneus:** a left chela having the form shewn in Fig. 198, II and III. Fig. 198, I shews a normal left chela of this species from the outside in the same position as II. In the abnormal specimen the dactylopodite *D* is normal save that

pectoral fin double, the division being in a *horizontal* plane, so that the two filaments were dorsal and ventral to each other [*cp.* No. 503]. ALBRECHT, *Sitzb. Ak. Wiss. Berl.*, 1886, p. 545, *Pl.* VI. **Silurus glanis**: extra fin attached to pelvic girdle and partly to rt. pelvic fin. WARPACHOWSKI, *Anat. Anz.*, 1888, III. p. 379, *fig.* **Rana esculenta:** left hind foot double; rt. not seen [a very clear case]. ERCOLANI, *Mem. Acc. Bologna*, 1881, S. 4, III. p. 812, Pl. IV. *fig.* 11.

In Raiidæ a group of cases of extra fin are known. They are upward projections from the dorsal surface near the middle line. They are often spoken of as "dorsal" fins, but in the only case I have seen (*Paris Mus. N. H.*, $\frac{7902}{A}$, kindly shewn me by Prof. L. Vaillant) the attachment is not really median but is slightly oblique, and seems, from external examination, to spring from some part of the pectoral girdle (? left scapula). See LACÉPÈDE (who named such a fish "*Raja cuvieri*"), *Hist. nat. des Poiss.*, 1798, I. p. 141, *Pl.* VII.; NEILL, *Mem. Wern. Soc.*, 1808, I. p. 554; MOREAU, *Poiss. de la France*, 1881, I. p. 206. In these fishes the real dorsal fins were in the proper place (though in some species they may be far forward, FORSKÅL, *Descr. Anim. in itin. Orient.*, 1775, I. p. 18). This repetition is of course quite distinct from that other curious and also Discontinuous variation in which the pectorals are partly divided into two lobes (**R. clavata**, YARRELL, *Brit. Fish.*, *ed.* RICHARDSON, 1859, II. p. 585); or are separated from the head so as to project like horns on either side, as in last case; and also in **R. clavata**, YARRELL, *ibid.*; p. 384; DAY, *Brit. Fish.*, II. p. 345, Pl. CLXXI. *fig.* 2; in **R. batis**, DAY, *l. c.*, p. 337; in **R. asterias**, BUREAU, *Bull. soc. zool. France*, 1889, XIV. p. 313, *fig.*

its point is rather worn. Where the index should be, there is a great eminence, bearing apically a second articulated dactylopodite D', complementary to D. Between the two dactylopodites

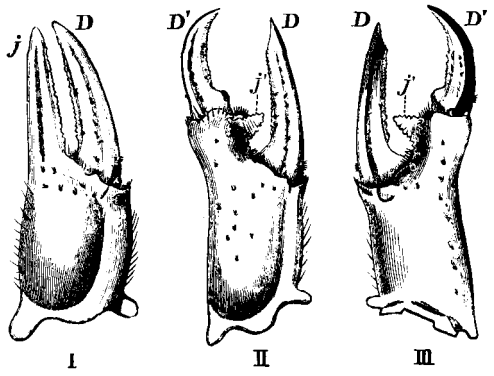

FIG. 198. *Hyas araneus*. I. A normal left chela. II. The left chela of No. 831 from the outside. III. The same from the inside. D, normal dactylopodite. D', extra dactylopodite. j, normal index. j', a small index toothed on both sides. (In Brit. Mus.)

at the inner side of the eminence there is a fixed short process, j', which is toothed upon both the edges which it presents to the two dactylopodites. Round the articulation of D' are setæ like those round the place of articulation of D. Specimen in *Brit. Mus.*, kindly shewn to me by Mr R. I. Pocock.

832. **Cancer pagurus:** right chela. Dactylopodite and index each double in the way shewn in Fig. 199. Each is toothed on the side presented to the other half-pincer. Note that there is no *proof* that one or other of these points is not a pair compounded in Position A or P, but since both seemed equally to diverge from the normal plane of the propodite this is most unlikely. Specimen in Museum of Newcastle-upon-Tyne.

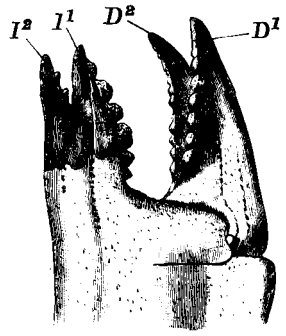

FIG. 199. Right chela of *Cancer pagurus*, No. 832. D^1, D^2, two partially separate dactylopodites. I^1, I^2, two *partially separate indices*. (*In* Newcastle Mus.)

833. **Homarus americanus:** right chela shewn in Fig. 200, I. Two dactylopodites separately articulating. Index bifid at apex and bearing two rows of teeth, *one on each edge*. Dactylopodites did not meet index. FAXON, *Harv. Bull.*, VIII. p. 260, Pl. I. fig. 13.

834. **? Hyas** sp. Right chela. Dactylopodite single and in normal plane. Two separate and similar indices, each toothed as usual,

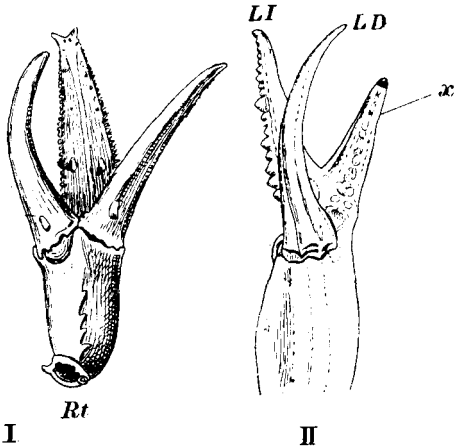

FIG. 200, I. *Homarus americanus*, right chela, No. 833. (After Faxon.) II. *Lupa dicantha*, left chela, No. 836. *LD*, *LI*, left dactylopodite and index. *x*, supernumerary index. (After Lucas.)

making angle of about 45° with each other. This angle almost exactly bisected by the plane in which dactylopodite moves. *Bell Collection*, Oxford.

835. **Maia squinado:** from inner side of base of index of right chela arises a second index as shewn in Fig. 201. It is about half as large as the supposed normal index. The latter is displaced outwards. Dactylopodite moves in approximately normal plane, missing both indices and falling between them. Specimen kindly lent by Prof. C. Stewart.

FIG. 201. Right chela of *Maia squinado*, No. 835.

The following are cases very similar to Nos. 834 and 835.

836. **Lupa dicantha,** left chela (Fig. 200, II). LUCAS, *Ann. Soc. ent.* France, 1844, S. 2, II. p. 43, Pl. I. fig. 1.

837. **C. pagurus,** right chela, 2 cases, LE SÉNÉCHAL, *Bull. Soc. Zool. France*, 1888, XIII. p. 125, *fig.* 2.

838. **Xantho punctulatus,** left chela (Fig. 202) in which the index divided at about its middle to form two similar and equally diverging blunt processes. HERKLOTS, *Arch. néerl.*, 1870, V. p. 410, Pl. X.

839. **Homarus americanus:** right chela bearing an extra index. Dactylopodite does not meet the normal index. [Very doubtful if of same nature as foregoing cases.] FAXON, *l.c.*, Pl. I. *fig.* 14.

The following cases are exceptional.

840. **Homarus vulgaris:** right chela has coxopodite single; but basi-

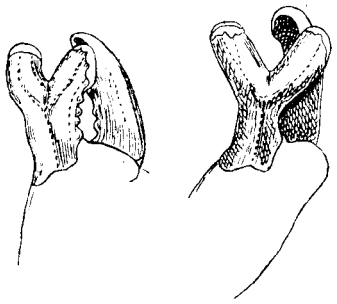

FIG. 202. *Xantho punctulatus.* Two views of left chela of No. 838, shewing the division of the index. (After Herklots.)

podite is wrinkled and has two apical articulations, each bearing a small chela; both are soft and not calcified, having articulations indicated by furrows only. [No information as to planes.] RICHARD, *Ann. Sci. Nat.*, 1893, p. 106.

841. **Homarus americanus:** right chela having a short articulated process below the dactylopodite moving in plane at right angles to it. [?a double structure]. FAXON, *Harv. Bull.*, VIII. Pl. I. fig. 12.

842. **H. americanus:** *toothless* process *articulating below* dactylopodite, moving in plane at right angles to its plane of motion. It articulates upon a separate process given by the propodite. [It is difficult to suppose that this extra process can be double.] FAXON, *l. c.*, Pl. I. fig. 16.

Mr G. DIMMOCK of Canobie Lake, N. H. has kindly sent me word of a **Gelasimus** having a chela of very anomalous form. Both index and dactylopodite are said to have been bifid, but the plane of division was *at right angles* to the plane of the dactylopodite and index, so that all four points were in one plane. This specimen has unfortunately been destroyed; but Mr Dimmock tells me that the arrangement was certainly thus, and that the unusual difficulty of bringing this case into agreement with others was recognized in examining it.

INSECTS.

Among the following 110 cases which all either have been or might be called cases of "duplicity" of legs, antennæ, or palpi, there is, I think, not one clear case of unmistakeable duplicity, such as for instance those of the chelæ in Nos. 831 or 832. They should thus be considered as cases in which the extra parts have not been or cannot be shewn to be double, rather than as examples of proved duplicity of normal appendages. In every case that I have myself properly examined, it is either possible to prove the duplicity of the extra parts; or else essential features (*e.g.* spurs &c.) by which a right appendage may be told from a left are wanting. Nevertheless the few straightforward cases of double-limbs in Crustacea keep one alive to the possibility that some of these also may be the same. The most probable cases of true duplicity of limbs are Nos. 844, 846 and 851.

*843. 1. *Legs.*

Prionus californicus (Longic.): *each* femur bore two tibiæ and tarsi; both maxillary palps and also the left labial palp were partially double (Fig. 203). [No statement as to *right* labial palp. This shewn in fig. much thicker than left, but on com-

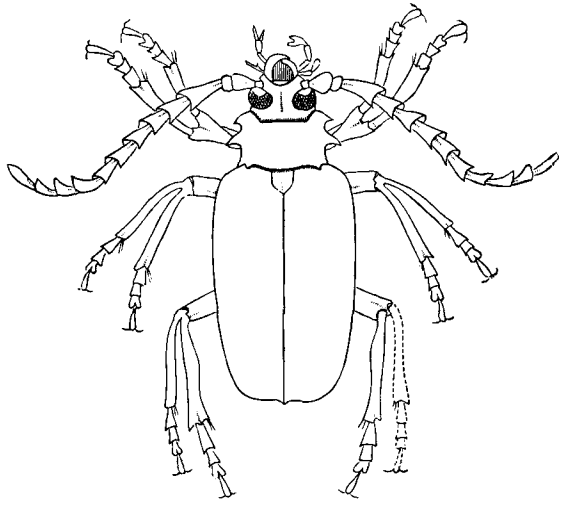

FIG. 203. *Prionus californicus*, No. 843, having extra legs and palpi. (After Jayne.)

paring with a specimen it seems to be of normal thickness.] In some of the legs the two tibiæ are compounded at their bases, in others they articulate separately. [Several details given; and in particular, enlarged views of the palpi and of the bases of the tibiæ. But as no details are given regarding the *apices* and apical spurs of the tibiæ nothing can be said as to symmetry.

It will be remembered that we have already had a case of a *Prionus*, No. 750, which similarly was supposed to have two of its legs double; but there by means of the tibial spurs it was shewn that the extra part was in Secondary Symmetry. Possibly enough the same could here be shewn. It is much to be hoped that this specimen can be traced.] JAYNE, H. F., *Trans. Amer. Ent. Soc.*, 1880, VIII. p. 159, fig. 12.

844. **Allantus** sp. (Tenthred., Sawfly): extra leg borne by coxa of right middle leg. This coxa is imperfectly double, bearing two separate trochanters. Of these the anterior bears a small leg which, though ill formed, is complete in all its parts, but has the tarsal joints of abnormally small size. The posterior trochanter bears a leg of full size. Its femur curves forwards and then backwards. The femur of the smaller leg curves for-

wards, but its tibia curves backwards. The femora are so twisted that I failed to determine the symmetry of these legs; and while it was clear that neither was a normal left it was equally doubtful whether either was shaped as a right. Of all cases in Insects this is one of the nearest to the condition of true duplicity. *Hope Collection,* Oxford.

845. **Carabus intricatus:** middle right femur is partially bifid, presenting two apices in the same horizontal plane. The anterior apex bears a tibia and tarsus of nearly normal form. The other apex bears a tibia and tarsus of full length but much more slender than a normal one. This leg was ill-formed. The tibia bore no spurs, and there was no indication as to its symmetry, and nothing shewed that it was a right or a left leg. It is stated in the original description that the two legs could be separately moved and that both assisted in locomotion. Originally described by MOCQUERYS, *Col. anorm.*, p. 45, *fig.*

*846. **Melolontha vulgaris:** right anterior leg divided to form two legs. The femur dilates in peripheral third to form two apices, each bearing a tibia. These two tibiæ are at right angles to the femur and are together in the same straight line, the one pointing forwards and the other backwards, each tibia turning its ventral or flexor surface towards the femur. The anterior tibia carries a tarsus of 4 joints with claws, while the posterior tibia has a normal tarsus of five joints. For a figure of this specimen and particulars concerning it I am indebted to Professor ALFRED GIARD.

847. **Leptura testacea** (Longic.): in tarsus of left middle leg the 2nd joint presents two apices (Fig. 204). The posterior bears normal 3rd and 4th (terminal) joints with a proper pair of claws. The anterior apex bears a narrow 3rd and 4th joint, the latter having only a single median claw [cf. No. 848]. KRAATZ, *Deut. ent. Zt.*, 1876, XX. p. 378, *fig.* 14.

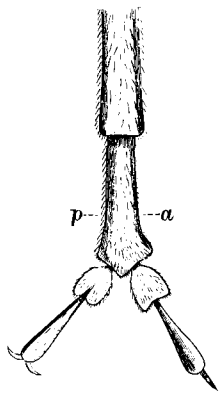

FIG. 204. *Leptura testacea*, No. 847. Tarsus of left middle leg from the plantar surface. (The property of Dr Kraatz.)

848. **Tetrops præusta** (Longic.): right anterior femur widened towards apex, which presents two articulations in same horizontal plane. Each of these bears a tibia. The posterior tibia and tarsus are complete in all respects, but they flex downwards and backwards. The anterior tibia has a normally 4-jointed tarsus, but the apical joint bears only *one* claw, and there is no sign of mutilation [cp. No. 847]. Were it not for the closely similar case of *Silis* No. 764 there would be no reason to doubt that this is a true case of duplicity, but that example shews how masked may be the doubleness of extra parts; and though I could not prove either of these legs to be double I feel no certainty that one of them is not double. Specimen very kindly lent for description by Mr F. H. WATERHOUSE.

849. **Chlænius holosericus** (Carab.): left anterior tibia enlarged and dividing close to base into two branches of similar form and length [curving towards each other], both equally furnished with hairs and bearing spines characteristic of the species. Anterior branch bears a complete tarsus like that of a leg *of the other side*, but posterior branch bears only one tarsal joint. CAMERANO, *Atti Ac. Sci. Torino*, 1878, XIV. *fig.*

*850. **Brachinus crepitans** (Carab.): 3rd joint of right posterior tarsus enlarged; 4th joint divides to form two apices (Fig. 205), each bearing separate 5th joint in same horizontal plane. Each of these has a pair

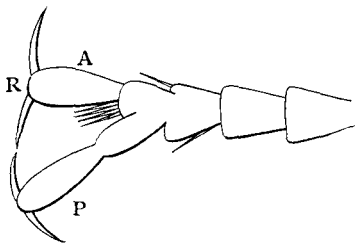

FIG. 205. Right hind foot of *Brachinus crepitans*, No. 850. A, anterior. P, posterior. R, the supposed normal right apex. (In Rouen Mus.)

of claws curving ventralwards. The two apical joints are not identical, the anterior being the shorter and continuing the general direction of the tarsus. I could not determine the symmetry. When examined by me the specimen was intact, but in cleaning it I broke this abnormal leg. First described by MOCQUERYS, *Col. anorm.*, 1880, p. 63, fig.

The two following cases differ from the rest in that the extra leg arose from the body separately from the normal leg. Among the cases of extra limbs in Secondary Symmetry were a few in which the coxa of the extra limbs was in the same socket as the coxa of a normal leg, though not united to it; but in the first, and perhaps in both of the two cases that follow, the extra leg was wholly separate. The first case, No. 851, is the only one of the kind that I have seen.

*851. **Tenthredo ignobilis** (Tenthred., Sawfly): extra leg arising from *prothorax*, on the left side of the body, at some distance behind the proper left anterior leg. Behind the anterior legs the prothorax of a normal specimen presents ventrally an elevation on each side of the middle line; the point of origin of the extra leg is about halfway between this elevation and the socket of the coxa of the normal left anterior leg. The specimen had been a good deal injured by being pinned very nearly through the point of origin of the extra leg, and on relaxing the specimen and attempting to restore the parts to their former positions I unfortunately broke off the extra leg from the body[1]. The leg is fairly well formed, but is a little shorter and a good

[1] The specimen has been mended as nearly as possible in the position originally occupied by the leg. As it may pass hereafter into other hands, it may be well to

deal more slender than the normal anterior leg. Owing to the slight degree to which the anterior legs of this insect are structurally differentiated from the middle legs, it cannot be positively stated that the extra leg is in form an anterior or a middle leg, but in size and general conformation it approaches very nearly to that of an anterior leg. It is complete in all its joints, having normal ciliation and claws, but *the spurs are entirely absent from the apex of the tibia* and probably have never been formed. This is an unfortunate circumstance; for, inasmuch as the anterior spur of a normal anterior tibia in this species is markedly differentiated from the posterior spur, it would have been easy to determine the surfaces of this leg had the spurs been present. As it is, the matter cannot be positively decided, and it must suffice to say that the general form of the leg and the shape and curvature of its joints are such as to make it appear to be fashioned as an anterior leg and as a leg of the side upon which it occurs, namely, the left. This specimen was most kindly lent for description by Mr C. W. DALE, of Glanville's Wootton, Dorsetshire. It is the specimen mentioned in *Ann. and Mag.*, 1831, IV. p. 21.

852. **Elater variabilis** (Elat.): complete extra leg articulating by separate coxa close to right anterior leg. GERMAR, E. F., *Mag. der Ent.*, II. p. 335, Pl. I. fig. 12. [This case has been copied by many authors. The figures represent the right fore leg and the extra one as normal right legs, but they are not sufficiently detailed to give confidence that this was so. If the specimen still exists it is to be hoped that it may be properly described.]

853. This is a list of all remaining cases in which it is in any way possible that there is duplicity of a leg. The point of origin is shewn approximately.

* , seen by myself. ‡, partly amorphous or mutilated. 0, no description. R, right. L, left. tr., trochanter. f, femur. tb, tibia. ts, tarsus.

* ‡ **Osmoderma eremita**[1] (Lamell.)	L 1. c.	MOCQUERYS, *Col. anorm.*, 1880, p. 46, *fig.*
Mallodon sp. (Longic.)	R 3. c.	*ibid.*, p. 50, *fig.*
Pasimachus punctulatus (Carab.)	L 2. tr.	JAYNE, *Trans. Amer. Ent. Soc.*, 1880, VIII. p. 156, Pl. IV. *fig.* 4.
Broscus vulgaris (Carab.)	R 1. tr.	IMHOFF, *Ber. Verh. nat. Ges. Basel*, 1838. III. p. 3.
Agonum sexpunctatum (Carab.)	R 3. f.	SCHNEIDER, *Jahresb. schles. Ges. vaterl. Kultur*, 1860, p. 129.
‡ **Carabus septemcarinatus** ♂	R 3. f.	KRAATZ, *Deut. ent. Zt.*, 1877, XXI. p. 57, Pl. I. *fig.* 32.
‡ **Carabus nemoralis**	L 3. f.	OTTO, HERM., *Term. füzetek*, 1877, I. p. 52, Pl. II.
Carabus creutzeri ♀	L 1. f.	KRAATZ, *l. c.*, *fig.* 31.
Procrustes coriaceus[2] (Carab.)	R 3. f.	MOCQUERYS, *l. c.*, p. 55, *fig.*
Meloe coriaceus (Het.)	L 1. f.	STANNIUS, *Müll. Arch. Anat. Phys.*, 1835, p. 306, *fig.* 11.
0 **Carabus helluo**	R 1. f.	REY, *Ann. Soc. Linn. de Lyon*, 1882, XXX. p. 423.
0 **Trichodes syriacus** (Cleridæ)	R 1. f.	*ibid.*
‡ **Chrysomela hæmoptera** (Phyt.)	? 3. f.	CURTIS, *Brit. Ent.*, Pl. 111, *fig.* 5*.

state explicitly that there was no conceivable doubt as to the genuineness of the abnormality. When received by me it was absolutely natural and had not been in any way mended.

[1] Probably this is the specimen mentioned by BELLIER DE LA CHAVIGNERIE, *Bull. Soc. ent. France*, 1851, S. 2, IX. p. LXXXII.

[2] See also KLINGELHOFER, *Stet. ent. Zt.*, 1844, V. p. 330.

‡	**Chlænius diffinis** (Carab.)	L 2. tb.	JAYNE, *l. c.*, p. 157, *Pl.* IV. *fig.* 7.
	Rhagium mordax (Longic.)	R 2. tb.	KRAUSE, *Stet. ent. Zt.*, 1871, XXXII. p. 136.
	Agabus uliginosus (Dytisc.)	R 3. tb.	PERTY, *Mitth. nat. Ges. Bern*, 1866, p. 307, *fig.* 6.
* ‡	**Acanthoderes nigricans** (Longic.)	L 2. tb.	MOCQUERYS, *l. c.*, p. 48, *fig.*
	Colymbetes adspersus (Dytisc.) ♂	L 3. tb.	KRAATZ, *Deut. ent. Zt.*, 1877, XXI. p. 56, Pl. I. *fig.* 14.
‡	**Procrustes coriaceus** (Carab.)	R 3. tb.	OTTO, HERM., *l. c.*, 1877, I. p. 52, Pl. II.
‡	**Carabus melancholicus** ♂	R 3. tb.	KRAATZ, *Deut. ent. Zt.*, 1880, XXIV. p. 344.
* ‡	**Tenebrio granarius** (Het.)	L 3. tb.	MOCQUERYS, *l. c.*, p. 49, *fig.*
* ‡	**Calosoma auropunctatum** (Carab.)	R 1. tb.	Lent by M. H. GADEAU DE KERVILLE[1].
0	**Silpha granulata** (Clav.)	R 3. tb.	RAGUSA, *Nat. Sicil.*, I. p. 281, *fig.*
*	**Philonthus succicola** (Staph.)	R 3. ts.	Lent by Dr MASON.
* ‡	**Telephorus excavatus** (Mal.)	R 2. ts.	MOCQUERYS, *l. c.*, p. 60, *fig.*
	Chlænius vestitus (Carab.)	L 2. ts.	*Ann. and Mag. N. H.*, 1829, II. p. 302, *fig.*
0	**Telephorus fuscus** (Mal.)	? 2 ?	BASSI, *Ann. Soc. ent. France*, 1834, S. 1, III. p. 375.
0	**Prionus coriaceus** (Longic.)	?	VON HEYDEN, *Isis*, 1836, IX. p. 761.
0	**Prionus** sp. (Longic.)	? ? f.	*ibid.*

2. *Antennæ.*

The remarks made in preface to the last section apply here also, and with additional force from the consideration pointed out (p. 513), that many antennæ are without obvious differentiation between their anterior and posterior surfaces. As Kraatz has pointed out, it is especially in such forms as Lamellicorns or Lucanidæ that extra antennæ are found *double*, and I think there is an obvious inference that this greater frequency in them is due to the fact that the two borders are so markedly differentiated that the duplicity cannot easily be disguised. I have sometimes fancied too that perhaps the existence of this great differentiation between the two borders may actually contribute to the physical separation of the two extra parts in the Positions A and P and thus prevent that masking of the duplicity which is seen for instance in *Navosoma* No. 801.

However this may be, special importance must be attached to the few cases in Lamellicorns, Lucanidæ and the like, where there seems to be a *single* extra part, making that is to say a duplicity of the antenna. Cases of this kind that I have myself seen I therefore treat more fully, and it may be stated that in none of them is there anything that can be called clear duplicity. In many on the contrary the extra part is nearly cylindrical, and thus symmetrical in itself. Hence it may possibly be morphologically double. Of the remainder I can give no confident account. For as has been said, though many, *e.g.*, *Zonabris* 4-*punctata* (in No. 858), do look very like cases of true duplicity

[1] Originally described by FLEUTIAUX, *Rev. d'Ent.*, 1883, p. 228.

I feel no certainty that they are so. Nothing but careful microscopical examination can shew this, and it would in every case be necessary to begin by fixing upon some definite character differentiating the anterior from the posterior border in the normal antenna.

In the majority of cases one of the branches has less than the normal number of joints.

Special attention is called to No. 854, for in it is seen not only an extra branch, but an *extra joint* in the course of the chief antenna.

N.B. At the end of this list I have set three cases of extra antenna arising from the *head*.

*854. **Lucanus cervus** ♂ (Lucanidæ): left antenna normal, practically same as that described for *Odontolabis* No. 799. Right antenna shews a rare condition. Scape and 2nd joint normal. Then follows a piece as long as the 3rd, 4th and 5th joints of a normal, together. This joint has a complex form. It has no *transverse* division and is clearly one segment from base to apex, but the posterior border is divided from the anterior by an irregular, crescentic suture, giving it the look of two joints spliced together. The *posterior* portion gives origin to a small, backwardly directed branch made up of two nearly spherical joints, the apical having a minute depression whence a fragment may have been broken.

The long third joint just described bears at its apex the rest of the antenna, which is abnormal in structure and diverges a little forward of the normal direction. In the normal there are only 7 joints peripheral to the 3rd, making 10 in all; here there are 8, making 11 in all. The four apical flattened joints are normal, but the joint preceding them (7th in this antenna) is more produced on the anterior border than in the normal, and it is thus in form *almost intermediate between a funicular and a lamellar joint*. The other three are simple funicular joints. For this singular specimen I am indebted to the kindness of M. Henri GADEAU DE KERVILLE.

855. **Nigidius** sp. (Lucanidæ) New Guinea: the second joint of the right antenna bears a small supernumerary three-jointed branch directed forwards and upwards. The terminal joint of the branch, which morphologically stands fifth from the body, bears a long hair of the kind which is borne in the normal antenna only by the seventh and subsequent joints.

There appears to be no deformation in the normal antenna in correspondence with the presence of this extra branch. The position of the antenna with reference to the second joint is a little altered, but it is not in any other way changed. This specimen was kindly lent to me by M. Henri GADEAU DE KERVILLE.

856. **Lucanus cervus** ♂: the second (1st funicular) joint of the left antenna bears a four-jointed, pointed filament. The lower

parts of the head on the left side are also greatly deformed. VON HEYDEN, *Deut. ent. Zt.*, 1881, XXV., p. 110, fig. 24.

857. **Melolontha vulgaris** (Lamell.): from ventral surface of 2nd joint of left antenna a separate joint projects vertically downwards. This joint bears a forwardly-directed process which is about as long as a normal club and is imperfectly divided into lamellæ. Nothing could be definitely determined as to the symmetry of this structure. Originally described by MOCQUERYS, *Col. anorm.*, p. 22, *fig.*

858. In this list * means that I have seen the specimen, ‡ that it is partly amorphous or mutilated, 0 that there is no description. The number is a rough indication of the joint from which the extra part arose.

* ‡ **Cicindela sylvatica** (Cicind.)	R 3.	*Mus.* H. GADEAU DE KERVILLE.
CARABIDÆ		
Carabus sylvestris ♂	R 8.	KRAATZ, *Deut. ent. Zt.*, 1877, XXI. p. 55, *fig.* 9, and SARTORIUS, *Wien. ent. Monats.*, 1861, v. p. 31.
C. auratus	R 2.	*ibid.*, *fig.* 8.
ditto	R 5.	DOUMERC, *Ann. Soc. ent. Fr.*, 1834, S. 1, III. p. 174, Pl. I.
ditto	L 8.	PERTY, *Mitth. nat. Ges. Bern*, 1866, p. 307, *fig.* 4.
C. italicus	8.	GREDLER, *Corr.-Bl. zool.-min. Ver. Regensb.*, 1877, XXXI. p. 139.
C. exaratus	L 5.	*ibid.*
C. intricatus	9.	*Ann. and Mag. N. H.*, 1841, p. 483.
C. emarginatus ♀	L 2.	VON HEYDEN, *Deut. ent. Zt.*, 1881, XXV. p. 109, *fig.*
C. cancellatus	R 10. / L 10.	SARTORIUS, *Wien. ent. Monats.*, *1858*, II. p. 49.
* ‡ **C. catenulatus** ♂	L 8.	*Brit. Mus.*
Pterostichus planipennis ♀	R 9.	KRAATZ, *l. c.*, p. 56, *fig.* 17.
Procrustes coriaceus ♂	L 7.	*ibid.*, *fig.* 10.
ditto ♀	5.	*ibid.*, 1881, XXV. p. 112.
Harpalus calceatus ♀	R 9.	*ibid.*, 1877, XXI. p. 57, *fig.* 24.
Calosoma sycophanta	L 9.	GREDLER, *l. c.*, 1858, XII. p. 195.
C. triste	R 6.	JAYNE, *Trans. Amer. Ent. Soc.*, 1880, VIII. p. 155, Pl. IV. *fig.* 1.
* ‡ **Anchomenus albipes**	L 10.	MOCQUERYS, *Col. anorm.*, 1880, p. 17, *fig.*
* **A. angusticollis**	R 8.	*ibid.*, p. 10, *fig.*
0 **Nebria** sp.	?	GREDLER, *l. c.*, 1869, XXIII. p. 35.
Agonum viduum	R 6.	VON HEYDEN, *Deut. ent. Zt.*, 1881, XXV. p. 109, *fig.* 19.
‡ **Ditomus tricuspidatus**	R 8.	*ibid.*, *fig.* 18.
Colymbetes coriaceus (Dytisc.)	R 5.	LUCAS, *Ann. Soc. ent. Fr.*, 1843, S. 2, I. p. 55, *Pl.*
Thylacites pilosus (Rhyn.)	L.	KRAATZ, *l. c.*, 1876, XX. p. 378, *fig.*
* **Rhynchites germanicus** (Rhyn.)	R 10. / L 9.	Lent by Dr MASON.
Cryptophagus scanicus ? (Clav.)	R 9.	KRAATZ, *l. c.*, 1877, XXI. p. 57, *fig.* 25.
C. dentatus	L 3.	SARTORIUS, *Wien. ent. Monats.*, *1861*, v. p. *31.*
0 **Monotoma quadricollis** (Clav.)	R.	REY, C., *Ann. Soc. Linn. de Lyon*, 1882, XXX. p. 424.
Chrysomela cacaliæ ♂ (Phyt.)	L 7.	LETZNER, *Jahresb. schles. Ges. vaterl. Kultur*, 1855, p. 106.
Adimonia tanaceti (Phyt.)	L 5.	SCHNEIDER, *ibid.*, 1860, p. 129.

HETEROMERA

‡	**Sepidium tuberculatum**	L 5.	PERTY, *l. c.*, *fig.* 10.
	Zonabris quadripunctata	L 6.	KRAATZ, *l. c.*, 1889, XXXIII. p. 221, *fig.* 14.
	Eleodes pilosa	R 9.	JAYNE, *l. c.*, p. 161, *fig.* 13.
*	**Blaps chevrolati**	L 7.	MOCQUERYS, *l. c.*, p. 11, *fig.*
	B. cylindrica	L 3.	*ibid.*, p. 6, *fig.*
	B. similis	R 8.	VON HEYDEN, *l. c.*, p. 109, *fig.* 22.
	Akis punctata	L 3.	BAUDI, *Bull. Soc. ent. ital.*, 1877, IX. p. 221, *fig.*

LONGICORNIA

0	**Prionus**[1] sp.	10.	*Ann. and Mag. N. H.*, 1841, S. 1, p. 483.
	Aromia moschata	6.	KRAATZ, *l. c.*, 1889, XXXIII. p. 221, *fig.* 15.
	ditto	R 2.	MOCQUERYS, *l. c.*, p. 18, *fig.*
*	ditto	L 5.	Lent by Mr JANSON.
‡	**Cerambyx cerdo** ♀	L 6.	VON HEYDEN, *l. c.*, p. 109, *fig.* 23.
‡	**C. scopolii** ♂	R 3.	KRAATZ, *l. c.*, 1877, XXI. p. 56, *fig.*
‡	**Lamia textor**	L 1.	SMITH, F., *Zool.*, VI. p. 2245.
* ‡	**Strangalia atra**	L 1.	MOCQUERYS, *l. c.*, p. 14, *fig.*
	S. calcarata	?	GREDLER, *l. c.*, 1858, XII. p. 195.
* ‡	**Solenophorus strepens**[2]	R 2.	MOCQUERYS, *l. c.*, p. 23, *fig.*
	Clytus arcuatus	R 5.	VON HEYDEN, *fig.* 21.
	Hammaticherus heros	L 7.	KLINGELHOFER, *Stet. ent. Zt.*, 1844, V. p. 330.
	Callidium variabile	L 3.	MOCQUERYS, *l. c.*, p. 24, *fig.*
	Lycus sp. (Mal.)	L 1.	VON HEYDEN, *l. c.*, p. 109, *fig.* 17.
*	**Telephorus lividus** (Mal.)	L 2.	Lent by Mr F. H. WATERHOUSE.
	T. rotundicollis	R 2.	JAYNE, *l. c.*, p. 159, *fig.* 11.
0	**Elater hirtus** (Elat.)	9.	BASSI, *Ann. Soc. ent. Fr.*, 1834, S. 1, III. p. 375.
	Ampedus ephippium (Elat.)	R 6.	KAWALL, *Stet. ent. Zt.*, 1858, XIX. p. 65.
	Chiasognathus grantii (Lucan.)	L 6.	WESTWOOD, *Proc. Linn. Soc.*, 1847, I. p. 346.
	Macrognathus nepalensis (Lucan.)	R 3.	KRAATZ, *l. c.*, 1880, XXV. p. 342, *fig.* 10.
	Julodis clouei (Bupr.)	R 5.	BUQUET, *Ann. Soc. ent. Fr.*, 1843, S. 2, I. p. 97, Pl. IV.

Extra antenna arising from the head.

*859.	**Callidium violaceum** ♀ (Longic.)	R.	VON RÖDER, *Ent. Nachr.*, 1888, XIV. p. 219.
	Saperda carcharias (Longic.)	L.	RITZEMA BOS, *Tijds. v. Ent.*, 1879, XXII. p. 208, *Pl.*
	* **Cerambyx cerdo** (Longic.)	L.	KRAATZ, *Deut. ent. Zt.*, 1889, XXXIII. p. 222, *fig.* 23.

3. *Palpi.*

Subject to the reservations made in regard to instances of duplicity in antennæ, &c., the following examples of supposed duplicity in palpi are given.

*860. **Nebria gyllenhalli** ♂ (Carab.): maxillary palps abnormal.

[1] I suspect that this is *Navosoma* No. 801.

[2] Doubtless the specimen mentioned by LUCAS, *Bull. Soc. ent. France*, 1848. S. 2, VI. p. XIX.

Fig. 206, I, shews the normal form of a right maxillary palp. Fig. 206, II, represents the *right* palp of this specimen. The 1st and 2nd joints are much thickened and the latter has 8 hairs (instead of 4) and two apical articulations, the anterior bearing

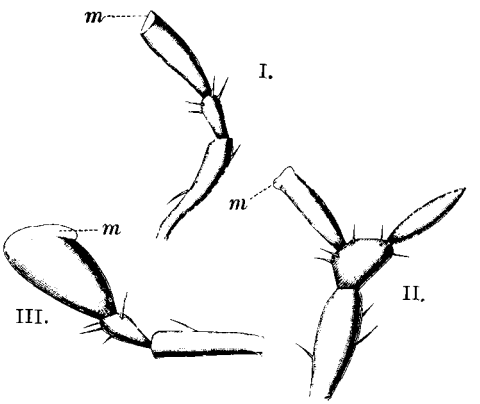

FIG. 206. *Nebria gyllenhalli*, No. 860. I. Normal right maxillary palp. II. Right palp of this specimen. III. Left palp of the same. *m*, terminal membrane. (The property of Dr Kraatz.)

an apparently normal terminal joint, the posterior bearing a symmetrical piece ending in a sharp point with no membrane like that at the apex of the normal. The *left* palp of this specimen is shewn in Fig. 206, III. In it the 2nd joint has 8 hairs instead of 4, and the terminal joint though very much enlarged is not divided at all. For the loan of this specimen I am indebted to Dr G. KRAATZ who first described it in *Berl. ent. Zt.*, 1873, XVII. p. 433, *fig.* 12.

861. **Carabus splendens**: penult. jt. of l. labial palp enlarged, and bearing two nearly similar jts. [broken before seen by me]. MOCQUERYS, *l. c.*, p. 29, *fig.*

862. **C. auratus**: 1st. jt. of l. maxillary palp bears two similar branches at rt. angles to each other, each with two jts. [Specimen not seen.] MOCQUERYS, *l. c.*, p. 30, *fig.*

863. **C. purpurascens**: extra labial palp on l. side. [Specimen not seen.] MOCQUERYS, *l. c.*, p. 32, *fig.*

4. *Mandibles.*

864. **Lucanus.** Three cases are recorded in which one of the mandibles bore an extra process of considerable size. Whether any of these are examples of duplicity, or whether the jaw, morphologically single, has in them varied towards a state of greater complexity, cannot well be said. The cases are **L. cervus** ♂, MOCQUERYS, *l. c.*, p. 106 [figure fairly true]; **L. cervus** ♂, KRAATZ, *Deut. ent. Zt.*, 1881, XXV. p. 111, *fig.*; **L. capreolus** ♂, *id.*, *l. c.*, 1876, XX. p. 378, *fig.*