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The studies on the ovipositors and 8th abdominal segments of some species of Bruchidae and Chrysomelidae (Coleoptera)

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Summary

Comparison of skeletal structures and musculature of the ovipositor with those of pregenital segments indicated that the ovipositor is derived from the abdominal segment 9. In Sagrinae, Orsodacninae, Eumolpinae and Timarcha (Chrysomelinae) the ovipositor has all the basic sclerites while in other groups some seclerites are reduced in various degrees, It seems that elongation of the ovipositor is a secon dary adaptation for egg - laying habit, because a short or a long ovipositor may have a complete set of sclerites. The structures of the ovipositor and of the abdominal segment 8 appear to have some taxonomic significance at generic level.

Introduction

The external male genitalia, the aedeagus, of Coleoptera has been extensively studied and its structural differences provide important systematic characters especially at the species level. However, the female external genitalia, the ovipositor, has been much less studied, and often ignored in systematic studies, though it also provides important characters at various taxonomic levels.

In this study, it was aimed to understand any taxonomic importance of structures of the ovipositor and 8. abdominal sternite in some Bruchidae and Chrysomelidae species.

The ovipositor of Coleoptera is composed of many components mainly derived from the ninth segment. However, the terminology and origin of these

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components have been much disputed among previous authors. In order to demonstrate the differences in the names applied by authors of major studies on ovipositor of the groups studied, we tabulated their various interpretations of the respective parts of the ovipositor, including our own.

In a primitive type of ovipositor in the groups studied, e.g. those of *Orsodacne, Timarcha,* etc., there are a dorsal, two lateral sclerites, ventral parts composed of 3 paired elements, and often a median sclerite, which is absent in *Timarcha.* As seen from the tabulation (Table 1) the main disagreement between the authors arises from whether a 10 th abdominal segment is present, if so, to which segment the parts of the ovipositor belong. Wandolleck (1905), Tanner (1927) and Iuga and Roşça (1962) accept the presence of 10. segment whereas Crowson (1955) does not recognize it considering that the dorsal sclerite or proctiger represents tergite 9, the lateral parts or paraproct represent probably the pleurites of segment 9, the ventral parts or valvifers represent a divided strenite 9, and the succeding parts represent the coxites and the styli as the appendages of the segment 9. To clarify this ambiguity, we dissected the ovipositor of *Timarcha tenebricosa* (Fig 1 L) finding that the tergal longitudinal muscles arising from the antecosta of the dorsal sclerite of the ovipositor (proctiger) attach to the antecosta of the tergite 8 and one muscle band arising from anterodorsal part of the lateral sclerite (paraproct) on each side attachs to the spiculum gastrale (intersegmental muscles), the other four muscle band originating from the paraproct attach to the ventral parts (valvifers) (segmental muscle), as also shown in *Atomaria ruficornis* (Marsham) (Cryptophagidae) by Evans (1961). These muscles are apparently homologous with those of the pregenital segments of Timarcha in which the tergal longitudinal muscles as well as the anterior group of 3 pleural muscles are always intersegmental but other groups of pleural muscles are segmental (Kasap, 1975). Thus, the dorsal sclerite of the ovipositor must be the tergite 9 (proctiger), as their tergal muscles attached to the tergite 8; the lateral sclerites must be pleural elements of the segment 9 (paraprocts) as they are well homologized whit those of the pregenital segments through their muscular structure, and the ventral parts (valvifers) must be belong to the sternite 9 and others (coxites and styli) must be appandages of the segment 9. A median sclerite found between the valvifers of some groups, which was called 10 th sternite by Tanner (1927), was called here the median plate, considering that it was a part of the sternite 9.

At rest, sternite 8 is always, and tergite 8 is usually, retracted inside the segment 7. The sternite 8 is modified forming an anteromedian rod, called spiculum gastrale (or spiculum ventrale) to which the protractor muscles of the ovipositor are attached. The segment 8 is protracted and retracted to-

Table 1 : Names and origins of components of the ovipositor in Coleoptera according to previous authors

The parts of a primitive ovipositor	*Wandolleck (1905)*	*Tanner (1927)*	*Iuga and Roşca (1962)*	*Crowson (1955)*	*In this study*
Dorsal sclerite	Tergite 10	Paraproct + proctiger	———	Proctiger (Tergite 9)	Proctiger (Tergite 9)
Lateral sclerites	Tergite 9	Valvifer	Hemisternite 9	Paraproct (Pleurite 9)	Paraproct (Pleurite 9)
Ventral parts	Sternite 9	Coxite I	Gonopod I	Valvifer (Sternite 9)	Valvifer (Sternite 9)
Median ventral part	Gleitplatte	Sternite 10	———	———	Median plate (Sternite 9)
Appendages	———	Coxite II	Gonopod II	Coxite (appendage)	Coxite (appendage)
Appendages	Stylus	Stylus	Gonostyle	Stylus (appendage)	Stylus (appendage)

gether with the ovipositor so it is closely associated with the genital organs. The sternite 8 and spiculum gastrale differ in shape and structure in different groups; these differences may be of systematically significant.

Material and Methods

Most of the species studied were supplied from the dry or spirit collections of the Zoology Department of Glasgow University and some species were collected either in vicinity of Glasgow or in Turkey.

The ovipositors of live specimens were directly dissected out while those of dry or previously fixed and preserved specimens needed a softening process before dissection. The softening was made through heating the specimens either in distilled water if the sclerites are less sclerotized or in 40 % KOH if the sclerites are strongly sclerotized. The abdomen was separated from the thorax and taken onto a dissection dish or glass. Then 8th abdominal segment and the ovipositor were pulled out by means of fine dissecting apparatus. Observations were at first made under a stereomicroscope. Then the material was permenantly mounted to study its fine details under a high power microscope. Drawingswere made under 100 x magnification in aid of a Camera Lucida attachment.

Results

Family : Bruchidae

The ovipositor of *Acanthoscelides obtectus* was figured by Tanner (1927), those of *A. obtectus, Bruchus pisi* L. and *Zabrotes subfasciatus* by Zacher (1930), that of *Bruchus quadrimaculatus* F. by Mukerji and Bhuya (1937) and those of *A. obtectus, Euspermophagus sericeus* (Fig. 2L), Z. *subfasciatus* and *Caryedon serratus* (Fig. 3 D,L) were studied in this work.

In *Bruchus, Euspermophagus* and *Zabrotes,* the ovipositor is rather short and all its compenents are very distinct. It is very difficult to interprate the ovipositor of *Bruchus* figured by Zacher (1930) and Mukerji and Bhuya (1937); they figured a vaginal palp, which may consist of stylus, coxite and valvifer, two ventral triangular sclerites, which may be paraprocts and a membranous proctiger. The ovipositors of *Zabrotes* and *Euspermophagus* are alike in having the proctiger with two baculi, no stylus and probably the coxite and valvifer are fused forming a small vaginal palp, the paraproct is distinct and as large as the vaginal palp in *Euspermophagus* (Fig. 2L) but absent in *Zabrotes.* The ovipositors of *Caryedon serratus* (Fig. 3) and *Acanthoscelides*

are moderately long, having most of the parts; the paraproct is not distinct in *Acanthoscelides*. The ovipositor of *Caryedon serratus* is a more specialized type (Fig.3). The proctiger distally divided in the middle, each side with a very narrow and very long baculus running proximally as in *Acanthoscelides;* the paraprocts form small baculi; the stylus is absent; the coxite and valvifer are fused forming a rather small vaginal palp. None of the species mentioned has a distinct median plate.

In the forms with short ovipositor, *Bruchus, Euspermophagus* (Fig. 2) and *Zabrotes* the segment 8 is not modified; the sternite 8 bears a moderately long non - articulated spiculum gastrale, attached to its anteromedian margin. This segment is a little modified only in *Euspermophagus,* the sternite 8 being gradually narrowed anteriorly to form the spiculum gastrale. In the forms with longer ovipositor, *Caryedon serratus* (Fig. 3) and *Acanthoscelides,* not the tergite 8 but the sternite 8 is very much reduced and modified forming a Y-shaped structure, whose longest part is the spiculum gastrale.

Family : Chrysomelidae

Sagrinae : The ovipositor of *Sagra congoana* (Fig. 4L,V,S) is rather short and broad and all its parts are distinct. The stylus is articulated to the coxite, while coxite and valvifer are partially fused with each other, but still distinguishable. The paraproct is posteriorly articulated with the valvifer and anterodorsally with the proctiger, which is divided into two lateral parts by a median membranous part. A small and rather sclerotized median plate is present (Fig. 4V).

Tergite is normal. Sternite 8 is a little reduced anteromedially with a rather long and non - articulated spiculum gastrale (Fg. 4S).

Orsodacninae : The ovipositor of *Orsodacne cerasi* (Figs.12L,D) is of a primitive type, lke that o *Sagra;* it is long and narrow and has all the parts articulating with each other in the manner described in *Sagra.* The stylus is moderately large and articulated with the coxite, which is fused with the valvifer anteroventrally, but distinctly articulated dorsally. The proctiger is weakly sclerotize posteriorly and divided into two lateral baculi anteriorly. A large and strongly chitinous median plate is present.

Tergite 8 is well sclerotized and the sternite 8 is anteriorly narrowed, ar ticulating with a long spiculum gastrale (Fig. 12D).

Donaciinae : Wandolleck (1905) figured the ovipositor of *Plateumaris braccata* Scop. and those of *P. discolor* (Figs.5 D,S), *P. braccata* and *Donacia simplex* (Figs.6D,V) were studied here.

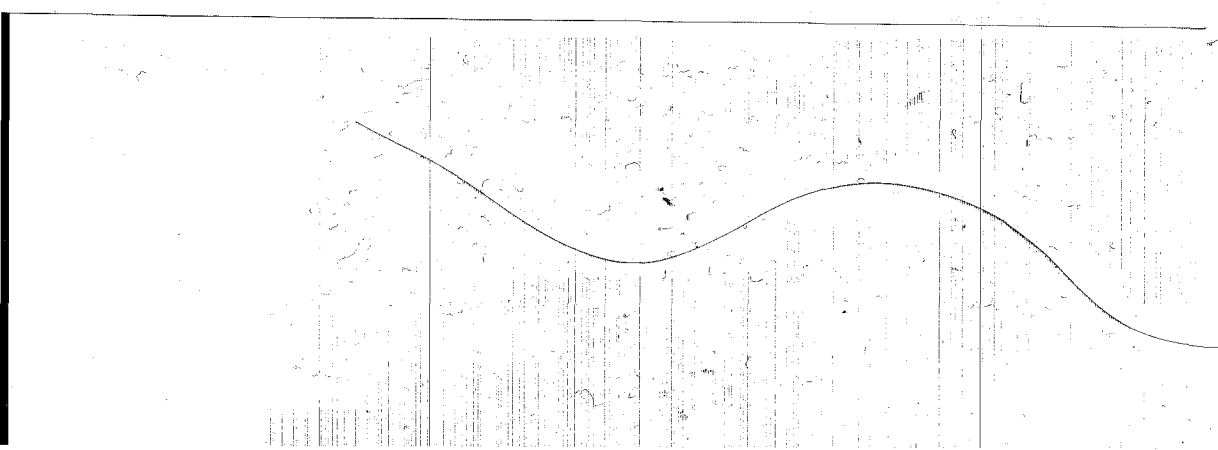
The moderately long ovipositor of *Donacia* consists of the proctiger, paraprocts and two vaginal palps; the proctiger and paraprocts are membranous and small, the stylus is apparently absent so that the vaginal palp is composed of the fused coxite and valvifer. The ovipositor of *Plateumaris* differs from that of *Donacia* in lacking the paraproct; in *P. discolor* the proctiger is not membranous but sclerotized and divided along the middle to two lateral parts.

A marked difference between these two genera is also seen in the structure of the segment 8. The main difference, previously noticed by Schwarz (1894), is that in the species of *Plateumaris,* the segment 8 froms the outher sheath of the ovipositor, with a smaller and narrower tergite and a wider and much longer sternite; the tergite is thinner (less sclerotized) and transparent, usually as long as wide with its apical margin rounded, subtruncate or feebly triangularly produced, whereas the sternite 8 is more elongate with parallel sides, terminating in an acute point. The rim of the sternite 8 is thickened and heavily sclerotized and its posterior edge is finely serrate in *P. discolor* (Fig. 5 S), not serrate but sharp in *P. braccata* (Wandolleck, 1905) and either finely or coarsely serrate or hot serrate but sharp in the other species of *Plateumaris* studied by Schwarz (1894). Apparently this segment forms an apparatus adapted to sawing into plant tissues. Schwarz (1894) observed that this apparatus was exserted at an angle with the tip of the abdomen so that the beetle could operate it like a saw moving up and down, eventually the sternite 8 deeply penetrated into the plant while the tergite 8 is lifted up and then the ovipositor proper is pushed through this opening to lay eggs in the slit. In *Donacia,* however, segment 8 is normal. *Plateumaris* live on emergent plants, while *Donacia* usually live on floating plants. Expectedly *Donacia,* unlike, *Plateumaris,* lay their eggs in sticking on or between the leaves (Geocke, 1935; Hoffmann, 1939).

It is also interesting to note that, in external examination the ovipositor apparatus of *Plateumaris* was often found to be slightly exserted, this may help in sex determination within the genus or in separating at least the females of this genus from those of *Donacia.*

Criocerinae : The 9th segment of *Oulema cyanella* (Fig.7D,V) is rather reduced and short. It consists of a membranous proctiger, small and sclerotized paraprocts and vaginal palps. Each vaginal palp may be composed of the fused coxite and valvifer, but apparently stylus and median plate are lacking.

Segment 8 (Fig. 7 D) is of normal structure with the spiculum gastrale a moderately long, terminally dilated and non - articulated outgrowth of sternite 8.



Megalopodinae : The 8th and 9th segments of *Sphondylia afra* (Fig.10 L) and *Zeugophora fulvicollis* are very long and narrow. In both genera the ovipositor proper consists of a small but distinct stylus and probably the fused coxite and valvifer but no proctiger, paraprocts or median plate.

The intersegmental membrane between the ovipositor and segment 8 is very wide, increasing the overall length of the ovipositor. The tergite and sternite of segment 8 are rather heavily sclerotized and laterally curved approaching to each other. The spiculum gastrale is narrow, long and clearly articulated to the sternite.

Camptosomata (Lamprosomatinae, Cryptocephalinae and *Clytrinae) :*

The ovipositors of *Cryptocephalus sericeus* (L.), *Pachybrachis piceus* Ws. (Cryptocephalinae), *Lachnaea sexpunctata* (Scop.), *Gynandrophthalma cyanea* (F.), *Macrolenes bimaculata* Rossi, *Clytra quadripunctata* (L.) (Clytrinae) were figured by Erber (1968) and of *Oomorphus concolor* (Fig. 8L) and *Labidostomis taxicornis* (Fig.9P) were studied in this work.

All these species have a similar type of very short and broad ovipositor, which may be typical of Camptosomata; the proctiger is divided into two lateral sclerites by a membranous median part, the paraprocts are rather large and sclerotized, the two vaginal palps are without distinct components except in *Oomorphus* (Fig. 8L) and a small median plate is usually present (Fig. 9P).

Segment 8 may be a little reduced as in *Labidostomis* and *Oomorphus,* much more so in *Clytra* or entirely lost in others mentioned above.

Chrysomelinae : The ovipositors of *Timarcha tenebricosa, Doryphora pyrrhoptera* Germ. and *Chrysomela (=Lina) populi* L. were studied by Wandolleck (1905) and of *T. tenebricosa* (Figs. 11 L,V,S.) and *Chrysolina americana* (Fig. 13 L were studied here.

They all have a rather short, broad ovipositor. That of *Timarcha* shows primitive features in having all the parts except the median plate; the proctiger consists of two lateral sclerites separated by a membranous median part, and paraprocts, valvifers, coxites and styli are well developed. Segment 8 in normal in shape and size, with a short, distally dilated and non - articulated spiculum gastrale (Fig. 11 S). In *Doryphora, Chrysomela* and *Chrysolina* (Fig. 13L) the proctiger is divided to two lateral sclerites by a wide membranous median part, and the lateral sclerite of proctiger on each side is fused with the paraproct laterally, the two vaginal palps have no distinct components and the median plate is absent. Segment 8 is normal, with no spiculum gastrale.

Halticinae : The ovipositors of *Longitarsus pratensis* Panz., and*Aphthona semicyanea* All. were figured by Iuga and Konnerth (1963) and of *Crepidodera transversa* (Fig. 15 D), *Haltica ericeti* were studied in this work.

They all have a similar moderately long and reduced ovipositor, with the proctiger divided in the middle only in *Crepidodera* and *Haltica* and other sclerotized parts are only two vaginal palps with no distinct components.

Tergite 8 is normal; sternite 8 is reduced in *Longitarsus, Aphthona* and *Haltica* forming a Y-shaped structure with the longest arm being a moderately long, non-articulated spiculum gastrale. In *Crepidodera* the sternite 8 is not reduced, giving rise anteromedially to a moderately long, non-articulated spiculum gastrale.

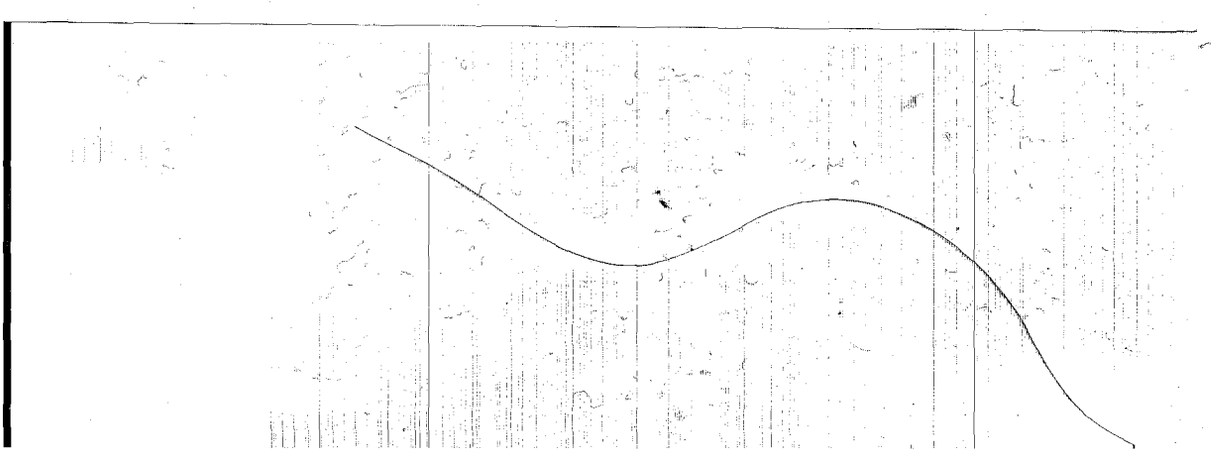
Galerucinae : The ovipositors of *Phylloboratica quadrimaculata* (Fig. 17L), *Luperus longicornis* (Fig. 14L) and of *Lochmaea suturalis* (Fig. 16L) were studied. Their ovipositors are moderately long and reduced, thus very smilar to those of Halticinae described above, but in *Lochmaea* the proctiger is also lost and therefore the anus is displaced under the tergite 8.

In the species studied, tergite 8 is normal but sternite 8 is rather reduced in size. A rahter long and non-articulated spiculum gastrale is present.

Eumolpinae : The ovipositors of *Chrysochares asiaticus* Pall. were studied by Wandolleck (1905) and of *Chrysochus cobaltinus* Lec. and *Glyptoscelis squamulata* Gr. by Tanner (1927) and of *Spilopyra sumptuosa* (Figs. 19 S, V) and *Ch. cobaltinus* (Figs. 18 D,L,V,) were studied in this work.

The ovipositor of *Spilopyra* is ofa primitive type having all the parts complete; the proctiger is divided in the middle forming two lateral baculi projecting anteriorly, the paraproct, valvifer, coxite and stylus of each side are clearly articulated to each other respectively, a small median plate is also present. In the ovipositor of *Chrysochus, Clyptoscelides* and *Chrysochares* all the parts are also present as in *Spylopyra* but in these genera, the coxite and valvifer are fused together and the latter is also fused with the paraproct lateromedially (Figs. 18 D,L,V). Neither species has the median plate.

In *Spilopyra* and *Chrysochus,* segment 8 is normal in shape and size; the spiculum gastrale is moderately long and wide in *Spilopyra* but is only a small *projection in* Chrysochus. In *Chrysochares* studied by Wandolleck (1905), tergite 8 is anteriorly divided in the middle by a membranous median area and the sternite 8 is more or less complete, with a moderately long non-articulated spiculum gastrale. Both the tergite and sternite of the segment 8 of *Glyptoscelis* figured by Tanner (1927) have two lateral narorw and elongate sclerites (baculi) and the sternite also bears a narrow median baculus projecting forwards, which may correspond to the spiculum gastrale.



Cassidinae : The ovipositor of *Cassida rubiginosa* studied (Figs. 20 L,V) is very much reduced, short and broad, the proctiger is divided into two lateral sclerites by a membranous median part. The sclerotized lateroventral part of the ovipositor may represent the fused paraproct and valvifer, while the coxite and styli may be represented by two short and wide weakly sclerotized or membranous vaginal palps. The median plate is absent.

Tergite 8 is normal and fully exposed but the sternite 8 is reduced forming a characteristic shape, with two narrow and laterally pointed apodemes (Fig. 20 V). The bifurcated spiculum gastrale is composed of two short and wide anteriorly projecting apodemes.

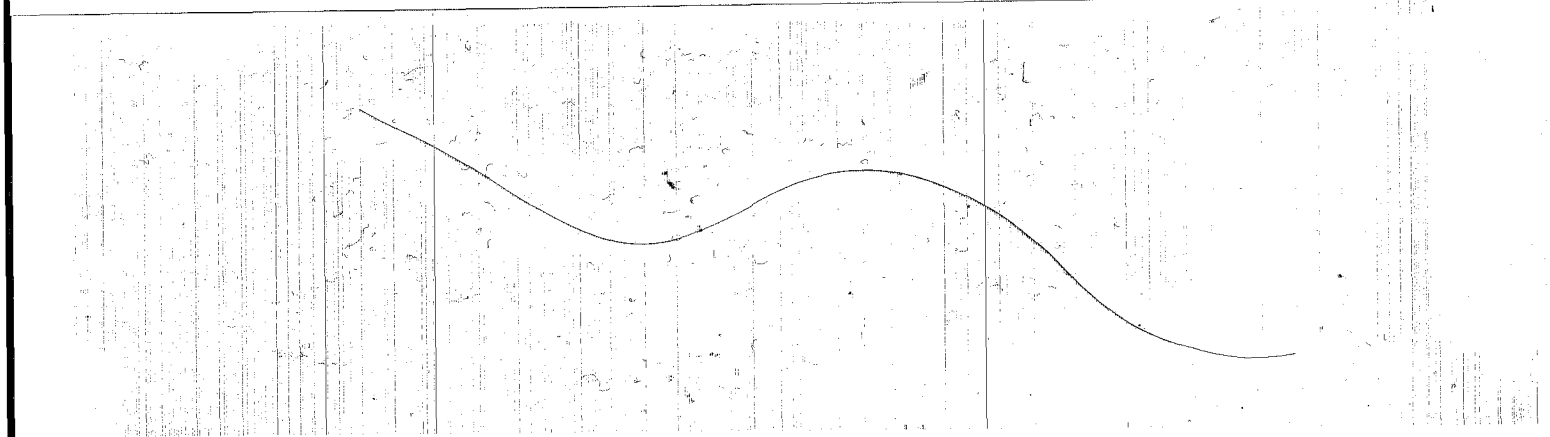
Hispinae : The ovipositor of *Baliosus ruber* (Web.) was studied by Tanner (1927) and of *Aproida balyi* (Fig. 21 V) and *Hispa testacea* (Fig. 22 D) was studied in this investigation. The ovipositor of *Baliosus* and *Hispa are* similar to each other in beingmore reduced than that of *Aproida*. In *Aproida* (Fig. 21 V), the proctiger is posteriorly V-shaped and sclerotized ,but anteriorly mebranous, the paraproct and valvifer are distinct and articulated to each other, the latter is posteriorly fused to the coxite forming the vaginal palp and the stylus is missing. In *Baliosus* and *Hispa* there are only the proctiger and two vaginal palps in which no parts are distinct and the paraprocts are apparently absent. In *Baliosus,* the proctiger has two lateral narrow and long baculi but it is entirely membranous in *Hispa* (Fig. 22 D). The median plate is absent in all of them.

Their tergite 8 is of normal shape and fully exposed. In *Aproida* (Fig. 21 V) the sternite 8 presents a characteristic structure, with a large posteromedian lobe and two lateral narrow arms and a moderately long spiculum gastrale. In *Baliosus* and *Hispa* (Fig. 22 S) the sternite 8 is rather reduced but more normal in shape, with only a short spiculum gastrale.

Discussion

A primitive type of ovipositor has all the parts distinctly articulated as in Sagrinae, Orsodacninae, *Timarcha* (Chrysomelinae) and Eumolpinae while in others two or more parts of it may be fused or lost; the most reduced type of ovipositor is represented only by vaginal palps as seen in Halticinae and Galerucinae.

The ovipositor is long in Orsodacninae and Megalopodinae, moderetaly long in some Bruchidae *(Acanthoscelides* and *Caryedon),* Donaciinae, Criocerinae, Galerucinae and Halticinae but very short in others studied. However, it is not always possible to argue that a long ovipositor is more primitive than a long ovipositor; i.e. a long ovipositor of *Orsodacne* (Fig. 12) and short



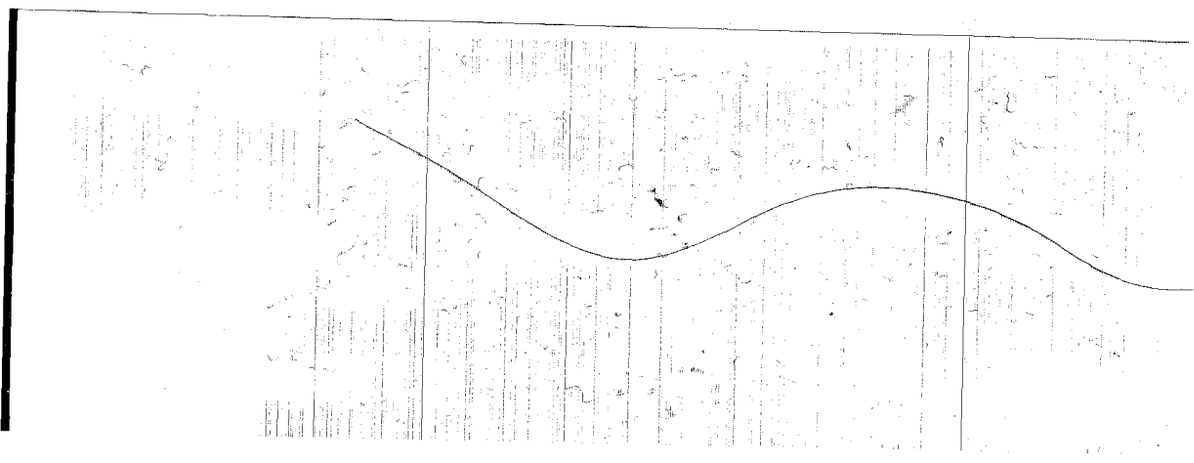
ovipositors of *Sagra* (Fig. 11), *Timarcha* (Fig. 11) and *Spilopyra* (Fig. 19) also have all the parts distinctly.

In the forms with a long ovipositor, usually the paraproct, proctiger and valvifer, even sometimes coxite are posteriorly drawn out into narrow and elongate sclerotized rods, called baculi.

The length of the ovipositor and of the spiculum gastrale are closely correlated; the species with a long ovipositor have also a long spiculum gastrale, the species with a moderately long ovipositor have a moderately long spiculum gastrale and those with a short ovipositor either have a short or no spiculum gastrale. The long spiculum gastrale is clearly articulated to the sternite 8. This may be a secondary development where the segment 8 is usually become elongate and slender, with its tergite and sternite laterally curved and usually fused to each other, as seen in Orsodacninae and Megalopodinae with a long spiculum gastrale. The spiculum gastrale apically bears the protrusor and retractor muscles of the sternite 8 and contraction of the former protrudes the segment 8 whereas the ovipositor itself is protracted by the blood pressure (Evans, 1961). So that the species with a long spiculum gastrale would have longer protrusor muscles and the segment 8, probably the ovipositor as well could be much more protruded than in those species with a short spiculum gastrale. The articulation of the spiculum gastrale may as well enable the segment 8 and the ovipositor to bend in different directions.

The length of the ovipositor is also correlated with the egg laying habit; the species with a long or moderately long ovipositor lay their eggs into special sites, such as into small crevices, under barks, into slits cut in plant tissues, etc. whereas the species with a short ovipositor usually lay their eggs into open sites, e.g. in higher Chrysomelinae, Cassidinae and Camptosomata the ovipositor is rather reduced, short and broad and hardly eversible; Chrysomelinae and Cassidinae lay their eggs on open surfaces, on leaves, etc. and Camptosomata stick their eggs into a special pit underheath the sternite 7 so that for these groups the eversion of the segment 8 and the ovipositor is barely necessary and indeed there is no spiculum gastrale in higher Chrysomelinae and Camptosomata and only a short one in Cassidinae.

The structural differences in the seggment 8 and the ovipositor of the species studied are important at generic and specific levels, e.g. in Donaciinae, *Plateumaris* can be distinguishable from *Donacia* in having the segment 8 adapted for sawing into the plants in oviposition (Fig. 5S) which is normal in *Donacia* (Fig. 6 V,D) and in lacking the paraproct which is present in *Donacia;* in Hispinae, *Aproida* (Fig. 21V) can be distinguished from *Baliosus* and *Hispa* (Fig. 22 D) by the ovipositor retaining all the parts



except the stylus, whereas the ovipositor of *Hispa* and *Baliosus* is much reduced; *Aproida* also has a characteristically shaped sternite 8 (Fig. 21 V), which is normal shaped in *Hispa* (Fig. 22 S) and *Baliosus*. Schwarz (1894) also recognized three species groups within *Plateumaris* according to the structure of the sternite 8, forming the outer sheath of the ovipositor with the tergite 8.

Özet

Bazı Bruchidae ve Chrysomelidae (Coleoptera) türlerinin ovipositor ve 8. abdomen segmentleri üzerinde çalışmalar

Ovipositor'un iskelet ve kas sistemi, pregenital segmentlerinki ile karşılaştırılarak ovipositorun 9. segmentten türevlendiği saptandı. Sagrinae, Orsodacninae, Eumolpinae, Timarcha (Chrysomelinae) gruplarında ovipositorun tüm skleritleri bulunduğu halde, diğer gruplarda bazı skleritler küçülmüş ya da kaybolmuştur. Skleritleri noksansız olan hem kısa hem de uzun ovipositorlu türlerin oluşu ile ovipositorun boyunun türlerin yumurtlama alışkanlığı ile ilgili bir uyum olduğu kanısına varıldı. Ovipositor ile 8. segmente ait yapısal özelliklerin taksonomik olarak cins düzeyinde önemli olduğu anlaşıldı.

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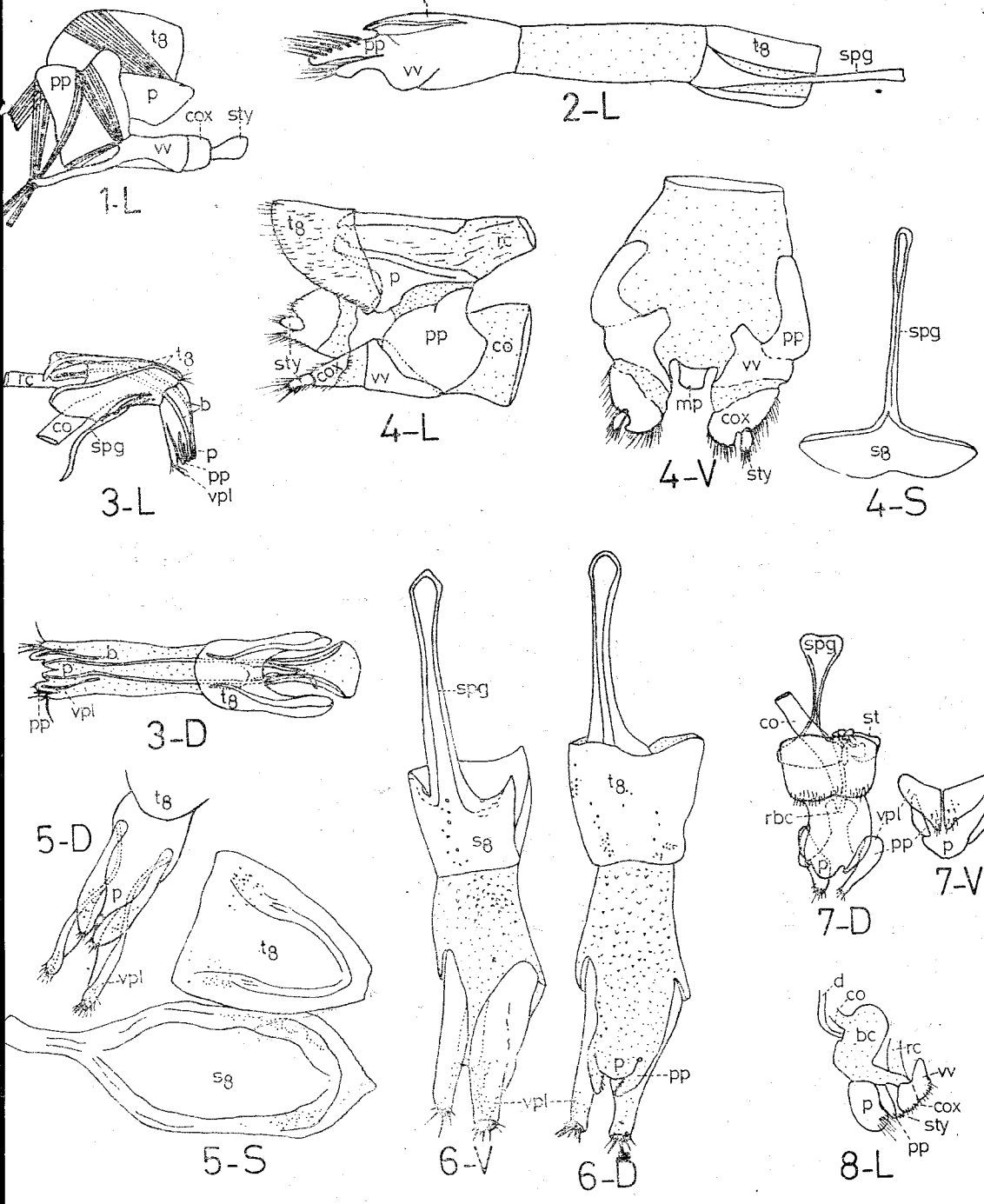
List Of Figures

(D-dorsal view, L-Lateral view, P-Posterior view, V-Ventral view, S-Sternite.

(IL) *Timarcha tenebricosa,* (2L) *Euspermophagus sericeus,* (3 D,L) *Carye-don serratus,* (4 L,V,S) *Sagra congoana,* (5 D,S) *Plateumaris discolar,* (6 D,V) *Donacia simplex,* (7 D,V) *Oulema cyanella,* (8 L) *Oomorphus concolor,* (9 P) *Labidostomis taxicornis,* (10 L) *Sphondylia afra,* (11 L,S,V) *Timarcha tenebricosa,* (12 D,L) *Orsodacne cerasi,* (13 L) *Chrysolina americana,* (14 L) *Luperus longicornis,* (15 D) *Crepidodera transversa,* (16 L) *Lochmaea suturalis,* (17 L) *Phyllobrotica quadrimaculata,* (18 D,L,V) *Chrysochus cobaltinus,* (19 S,V) *Spilopyra sumptuosa,* (20 L,V) *Cassida rubiginosa,* (21 V) *Aproida balyi,* (22 D,S) *Hispa testacea.*

Explanation of figure lettering

b : baculus, cox : coxite, mp : median plate, pp : paraproct,
spg : spiculus gastrale, s : sternite, sty : stylus, t : tergite,
vpl : vaginal palp, vv : valvifer.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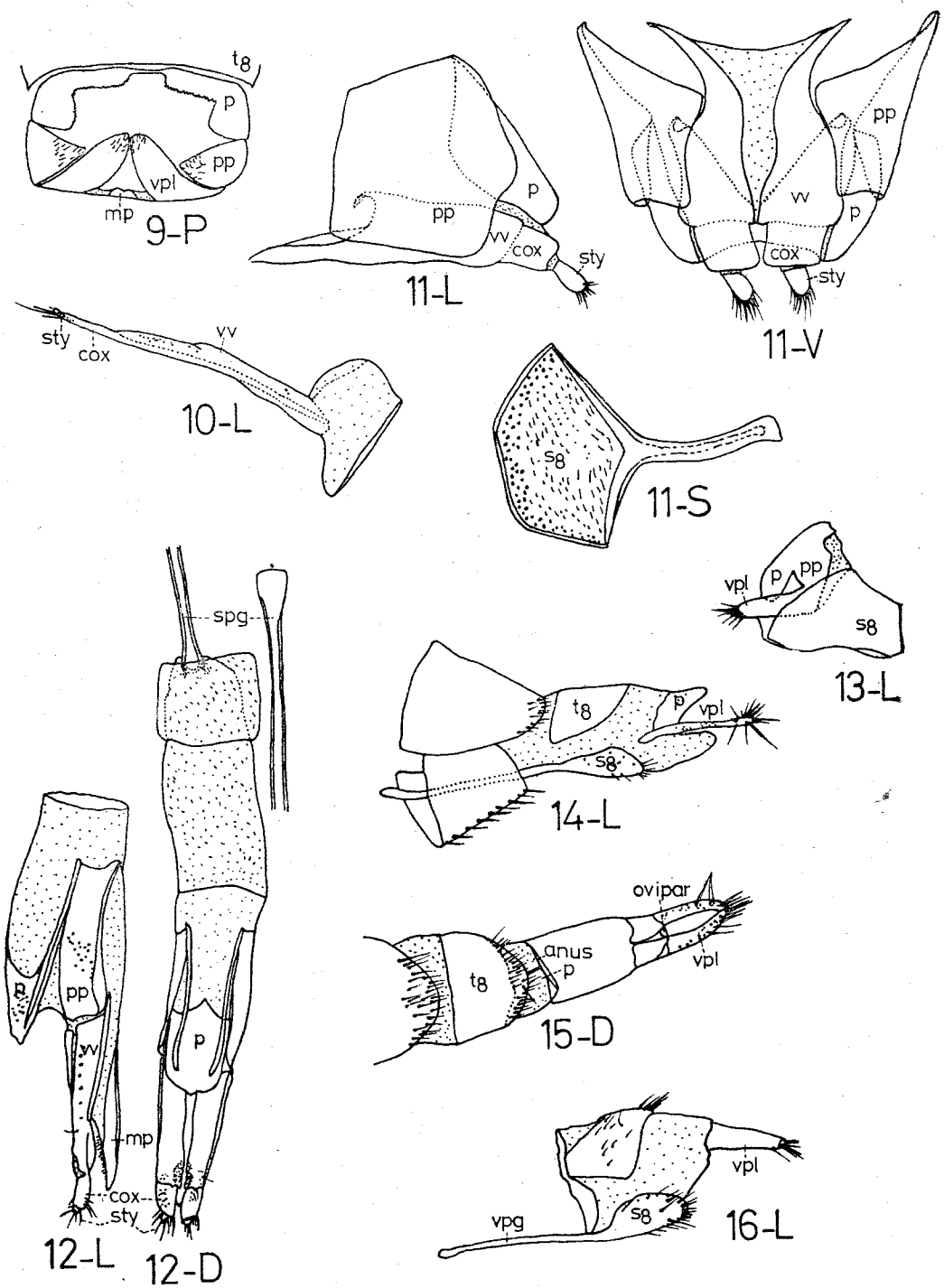
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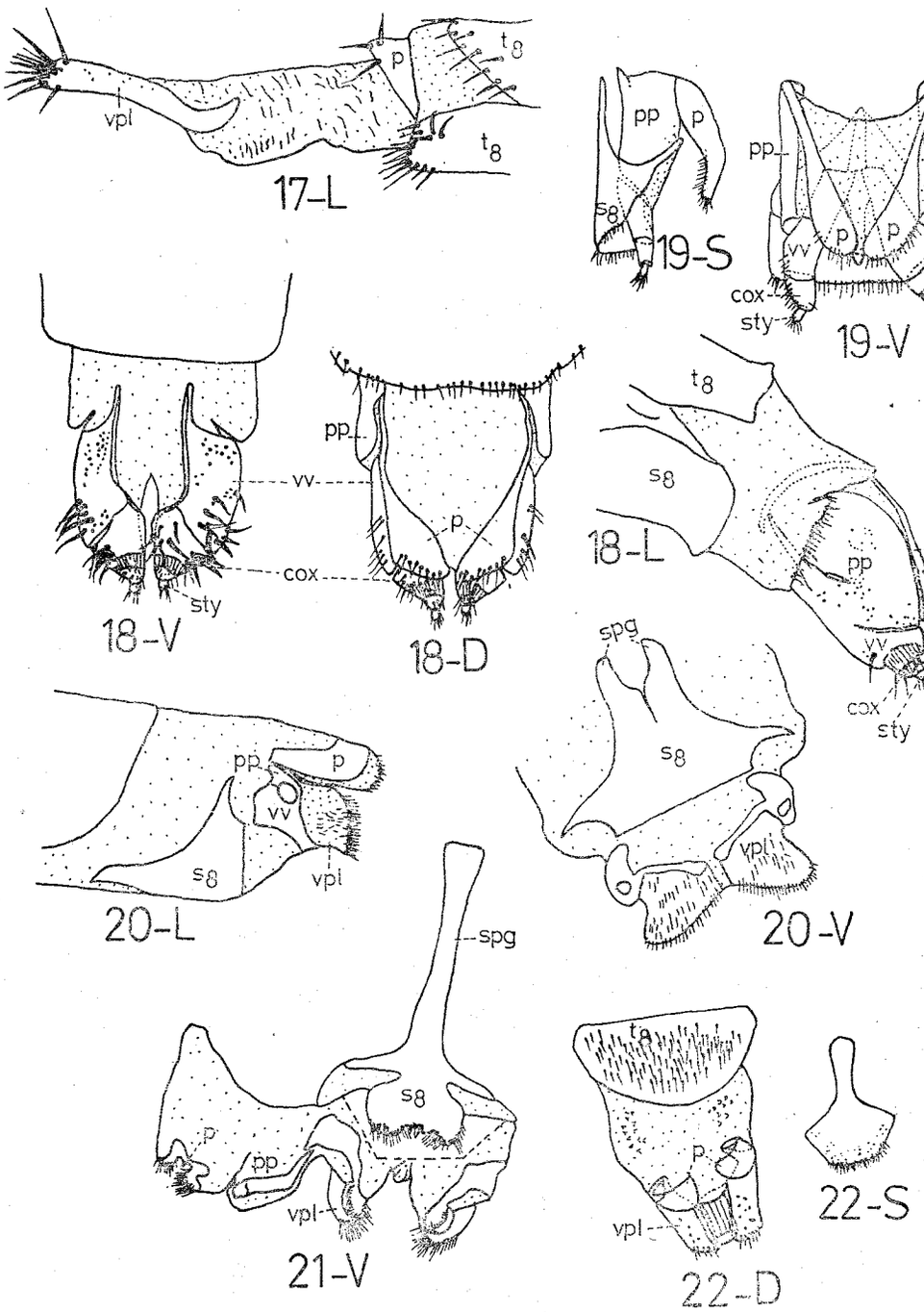
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