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On the Digitiform Sensilla of Adult Leaf Beetles (Coleoptera: Chrysomelidae)

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This study is to find out to what extent differences in number and arrangement of the digitiform pegs of the palpi maxillares in Chrysomelidae correspond to systematic and phylogenetic divisions, and to what extent they are correlated with differences in adult habits. With the aim of establishing a primitive pattern of the pegs in Chrysomelidae, comparisons were also made with representatives of related familiae, Bruchidae and Cerambycidae, and also with primitive Curculionoidea. – In the larval development of *Chrysolina polita* Linnaeus 1758, the single peg does not increase significantly in successive instars, unlike other larval organs.

This suggests that endopolyploidy or cell division do not occur in it. – A U-shaped assemblage of pegs is characteristic of primitive groups like Orsodacninae, Sagrinae, Aulacoscelinae and Megalopodinae, and is likely to be primitive in the familia. In Donaciinae, the pegs are usually fewer than in similar-sized species of other subfamiliae, and are absent in the fully aquatic *Macroplea* – a parallel to aquatic groups in Hydrophiloidea and Adephaga. Otherwise, the patterns vary considerably in most subfamiliae and seem to be of relatively low systematic value. They offer some support for the view that ancestral Chrysomelidae had actively flying floricolous adults. Reasons are given for accepting the view that the pegs function as proprioceptive vibration receptors.

1 Introduction

The digitiform sensilla are elongate finger-like pegs. In imagines of Insecta, they lie in longitudinal grooves on the outer side of the apical segment of the palpi maxillares.

Honomichl [1980] investigated these sensilla in 35 species of Coleoptera, including 2 Chrysomelidae. Zacharuk [1962a] and Zacharuk & Bellamy [1976] studied the ultrastructure and function of similar sensilla on the palpi labiales of larvae of a species of Elateridae; they found evidence that they were vibration receptors. Guse & Honomichl [1980] suggested them to be hygro- and thermoreceptors.

The present studies include investigations on the topography, number and arrangements of sensilla in 60 species of Chrysomelidae from N' India and Scotland, several Cerambycidae and Curculionoidea.

2 Material and Methods

Many of the specimens utilised in this study were collected from N' India [1975–78] and Scotland [1980]. The right and left palpi maxillares of both ♂♂ and ♀♀ of adult

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Tab 1 (continued)

Monolepta signata	♀	10	21	0.136	3.88
Olivier 1808	♂	8	40		4.6
Paridea octomaculata	♂	10–12	32	0.142	8.49
Baly 1886	♀	10	37		9.2
Phyllobrotica quadrimaculata Linnaeus 1758	♂	4	32	0.165	5–7
Sphenoraia bicolor	♂	4	31	0.079	6.88
Hope 1831	♀	6			
Galerucella rugosa	♂	6	24–26	0.0826	5.34
Jacoby 1884	♀	7	20		5.94
Diorhabda lusca	♂	4–5	28	0.123	5.38
Maulik 1936	♀	3–4	27		5.58
5. Halticinae					
Luperomorpha nigripennis	♂	5	28	0.099	3.61
Duvivier 1892	♀	5	28		3.88
Derocrepis rufipes	♂	7	43	0.099	2.7–3.2
Linnaeus 1758	♀	6	35		
Haltica ericeti Alluaud 1859	♀	5	27	0.07	4–5
Haltica cyanea	♂	8	28	0.132	5.00
Weber 1801	♀	6–7	29		
Hyphasoma nigricorne Baly 1978	♂	9	32	0.165	5.5
6. Chrysomelinae					
Chrysolina exanthematica Wiedemann 1821	♀	14	33	0.264	8.73
Chrysolina polita	♀	25	30	0.165	6.45
Linnaeus 1758	♀	17	40		7.76
Chrysolina varians Schaller 1783	♂	8	29	0.182	4–6
Gastroidea viridula	♂	9	31	0.198	4.92
DeGeer 1775	♀	10			6.00
Phaedon tumidulus Gernar 1824	♀	6	40	0.2	3.88
Phyllodecta vulgatissima	♂	8	30	0.132	4.36
Linnaeus 1758	♀	5	26		4.94
Phytodecta pallida Linnaeus 1758	♂	10	30	0.23	5–7
7. Sagrinae					
Sagra adonis Lacordaire 1845	♀	26	42	0.218	18.92
Sagra femorata Drury 1773	–	15	31	0.495	16–20
8. Donaciinae					
Donacia crassipes Fabricius 1775	♀	2	27	0.193	9–13
Plateumaris discolor	♂	11	32	0.198	6.5–9
Panzer 1795	♀	13	37		
9. Hispinae					
Dactylispa peregrina Maulik 1919	♂	7	37	0.231	5–5.5
10. Cassidinae					
Cassida flaveola Thunberg 1794	♂	18	37	0.231	3.5–4.5
Laccoptera nepalensis Boheman 1855	–	8	29	0.2244	7.76
Glyphocassis trillineata Hope 1831	–	8	36	0.198	6.06
11. Criocerinae					
Lema coromandeliana	♂	7	32	0.132	5.94
Fabricius 1798	♀	6			6.79

Tab 1 (continued)

Oulema globicollis Baly 1865	♀	4	27	0.12	3.88
Oulema cyanella Linnacus 1758	♂	5	26	0.11	3.64
	♀	6	30		
12. Megalopodinae					
Sphondylia afra Klug 1824	–	24	27–32	0.528	12.93
13. Zeugophorinae					
Zeugophora flavicollis Marsham 1802	♂	11	23	0.165	2–3
14. Lamprosomatinae					
Oomorphus concolor Sturm 1807	♀	3	29	0.145	2–3
15. Chlamisinae					
Fulcidax monstrosus Fabricius 1798	♀	10	29	0.307	11.75
16. Clytrinae					
Diapromorpha turcica	♂	7	24	0.165	6.24
Fabricius 1801	♀	7	25		6.55
Smaragdina spec indet	♂	6	26	0.099	4.85–5.0
	♀	9–10			5.82
17. Cryptocephalinae					
Cryptocephalus analis	♂	6	26	0.235	6.24
Oliver 1808	♀	4–7	27		6.24
Cryptocephalus divisus	♂	3	25	0.165	4.00
Jacoby 1903	♀	4	27		
Cryptocephalus herbsti	♂	5	24	0.16	2.5
Suffrian 1854	♀	7	28		
Cryptocephalus sexsignatus	♂	5–6	26–27	0.198	5–8
Fabricius 1801	♀	6–7	26–28		
Cryptocephalus labiatus Linnaeus 1761	–	2	17–18	0.099	2–3

elongate U-shaped figure as in *Orsodacne, Cucujopsis, Sphondylia, Caryedon,* various Sagrinae, and in *Cheloderus* (Disteniidae), and to some extent the Cerambycidae *Grammoptera* etc., also in the floricolous *Bruchela* (Anthribidae) and *Nemonyx* (Nemonychidae) in Curculionoidea. A similar pattern recurs in a number of cucujoid groups of similarly diurnal and floricolous habits, where the palpi are not securiform e g in *Cychramus* among Nitidulidae, *Olibrus* in Phalacridae, *Telmatophilus* in Cryptophagidae, and *Byturus:* those Heteromera with floricolous habits, e g in Mordellidae, Scraptiidae, Oedemeridae, Pyrochroidae etc., nearly always have securiform palpi, which never bear a U-shaped array of digitiform pegs.

It may be that the U-shaped array is derived by extension of an originally simple transverse row, as a method of increasing the number of pegs in a narrow palpus – we have not found an array of this type in any species with the last palpal segment strongly broadened or securiform.

Systematically, the large majority of Chrysomelidae are distinguishable from Cerambycidae by having the array of digitiform pegs centred in the basal rather than the apical half of the last segment of the palpi. The main exception is *Timarcha,* which has a Cerambycidae-like array situated near the apex of the unusually broad palpal segment. Of the Disteniidae, *Vesperus* has a Cerambycidae-like array, but *Cheloderus* (Oxypeltinae) has

an elongate U-shaped array extending over most of the outer face of the segment, very much as in most Megalopodinae.

Among the Bruchinae, *Caryedon serratus* Olivier 1790, representing the probably primitive and Sagrinae-like Pachymerinae, has an array of about 8 moderately long pegs, parallel and with their bases forming a rather asymmetrical and moderately deep arcuate curve, while the smaller *Rhaebus gebleri* Fischer 1824 [Rhaebinae] show 4 or 5 pegs lying parallel to each other in a transverse row in the basal half of the segment. *Euspermophagus sericeus* Geoffroy 1785 Amblycerinae shows 3–4 pegs in a similar transverse row, and the smaller *Callosobruchus chinensis* Linnaeus 1758 has 2–3 pegs lying side by side. *Caryedon* has the pegs rather more distally inserted, more or less as in some Sagrinae [*Carpophagus*], and the array itself has rather more the appearance of an abbreviated version of the Sagrinae type.

It is noteworthy that most adult Bruchinae preserve what we believe to be the primitive floricolous and pollinivorous habits of the Chrysomelidae line, with a well developed asperate mandibular mola and the apical hairs of the galea more or less plumose, but only *Caryedon* of the species studied shows something approaching the U-shaped array of digitiform pegs which commonly accompanies such habits. *Caryedon* species are considerably larger than those of the other Bruchinae genera studied, and have a greater number of digitiform pegs. It thus appears that the loss of the U-shaped array in Bruchinae is a correlative of a reduction in body size from a Sagrinae-type ancestor.

The single digitiform peg of the larva of *Chrysolina polita*, in the newly-hatched and full-grown stages, is about as long as those of the adults; it differs from the adult pegs and resembles the larval one of *Speophyes lucidulus* Delarouzee 1860 described by Corbière [1967, 1969] in being freely exposed rather than enclosed in a groove. The studies of Corbière (loc cit), Zacharuk, Albert & Bellamy [1977] and Honomichl & Guse [1981] suggest that digitiform pegs of Chrysomelidae are likely to be formed from a fixed number of cells, so that differing sizes of the pegs probably reflect differing cell-sizes in the species concerned.

The apparent constancy of peg-size during the larval development of *C. polita* despite approximate doubling of the linear dimensions of the apical palpal segment, is anomalous. In successive instars of Endopterygota larvae, the usual process affecting ectodermal structures of the larva is one of endopolyploidy, successive doublings of larval cell chromosomes without cell division, producing larger and larger cells. This process, however, appears not to affect the larval digitiform peg in *C. polita*, which behaves almost as if it were an "imaginal disc" precursor of the adult organs. Unfortunately we have not had *Chrysolina* pupae available for study of their palpi maxillares.

The enclosure of the digitiform pegs in grooves, and the frequent presence of long setae projecting over them would, as pointed out by Honomichl & Guse [1981], protect them against outside contacts, while the absence of any cuticular pores should preclude the possibility of their functioning as chemoreceptors; they show no resemblance to any described insect thermoreceptors, and Zacharuk's work gave no indication of particular concentration of thermoreceptor functions on the last segment of the labial palpi (where the pegs occur in Elateridae larvae).

Electrophysiological study by Zacharuk, Albert & Bellamy [1977] gave evidence of response to vibrations – presumably a kind of proprioception of vibrations in the palpus itself. This might be mediated by inertial movements of liquid in the continuous lumen which is normally present in the peg. The tendency towards having less pegs in aquatic species might be related to a much lower tendency of the palpus to vibrate in an aqueous than in an aerial medium.

5 Acknowledgements

We are thankful to Professor K. Vickerman, Head of the Zoology Department, University of Glasgow, for placing the entomological collections of the Hunterian Museum of the University at our disposal, and also to Mr. R.D. Pope of The British Museum for the loan of some chrysomelid species. J.S. Mann is indebted to the Government of India, without whose financial support this work could not have been carried out.

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Chrysomelidae were detached and mounted on the adhesive surface of the stubs with the outer lateral surface of the apical segment of the palp pointing upwards. The stubs were processed for scanning microscopy. Many specimens from the Hunterian Museum, Glasgow University, British Museum (Natural History), London and Dr R. A. Crowson's personal collections were also investigated.

3 Observations

3.1 Familia Disteniidae

In *Cheloderus childreni* Gray 1832 (Oxypeltinae), the sensilla are arranged in an elongate U-shaped pattern, occupying most of the outer side of the segment. This arrangement is rather similar to that in primitive Chrysomelidae, e g *Orsodacne, Sphondylia, Aulacoscelis* and *Sagra adonis*. The tips of the sensilla are directed towards the central axis of the pattern, and they lie deeply sunk in the grooves. In *Vesperus* (Vesperinae), the arrangement of the sensilla is Cerambycidae-like and they are set in a cluster (of about 28 sensilla) near the apex of the segment. The tips of the sensilla are directed towards the apex of the segment.

3.2 Familia Cerambycidae (Fig 1, 4).

In all the representatives studied, the sensilla are situated near the apex of the segment. They are deeply sunk in the grooves. The arrangement may be in a horizontal row as in *Leiopus nebulosus* Linnaeus 1758 (Fig 4) or in an irregular cluster as in *Rhagium bifasciatum* Von Linné 1775 (Fig 1). The tips of the sensilla are always directed towards the apex of the segment. The sensilla are numerous in *Rhagium* and 10–11 in *Leiopus*.

3.3 Familia Chrysomelidae

3.3.1 Subfamilia Orsodacninae (Fig 7).

In *Orsodacne cerasi* Linnaeus 1758 (Fig 7) *O. vittata* Say 1823 and *Hemydacne maculicollis* Jacoby 1897 the sensilla are set in a U-shaped pattern at the base of the segment. They are deeply sunk in the grooves with their tips pointing towards the median axis of the U-shaped pattern and are numerous. In *Cucujopsis setifer* Crowson 1946 the position and arrangement of the sensilla is similar to that of *Orsodacne cerasi*, with the sparsely arranged sensilla occupying most of the outer side of the segment.

3.3.2 Subfamilia Synetinae (Fig 10)

The sensilla are situated in the middle of the segment in *Syneta betulae* Fabricius 1772 (Fig 10), *S. ferruginea* Germar 1811 [= *Hornibius sulcifrons* Fairmaire 1891] and *S. pilosa* Brown 1940. They lie in shallow grooves of the cuticular folds and the tips of the irregularly arranged sensilla are directed towards the apex of the segment.

3.3.3 Subfamilia Galerucinae (Fig 8, 22)

In the members of this subfamilia studied here, the sensilla are set in a shallow transverse curve near or at the base of the segment. The sensilla rest in shallow grooves, with their tips directed towards the apex of the segment. The arrangement and number of the sensilla may vary in a species and also between the right and left palps of the same individual. There are a number of pores at the base of each sensillum in most of the species studied. Zacharuk [pers comm] regards them as sensilla campaniformes. The ♀♀ have more sensilla

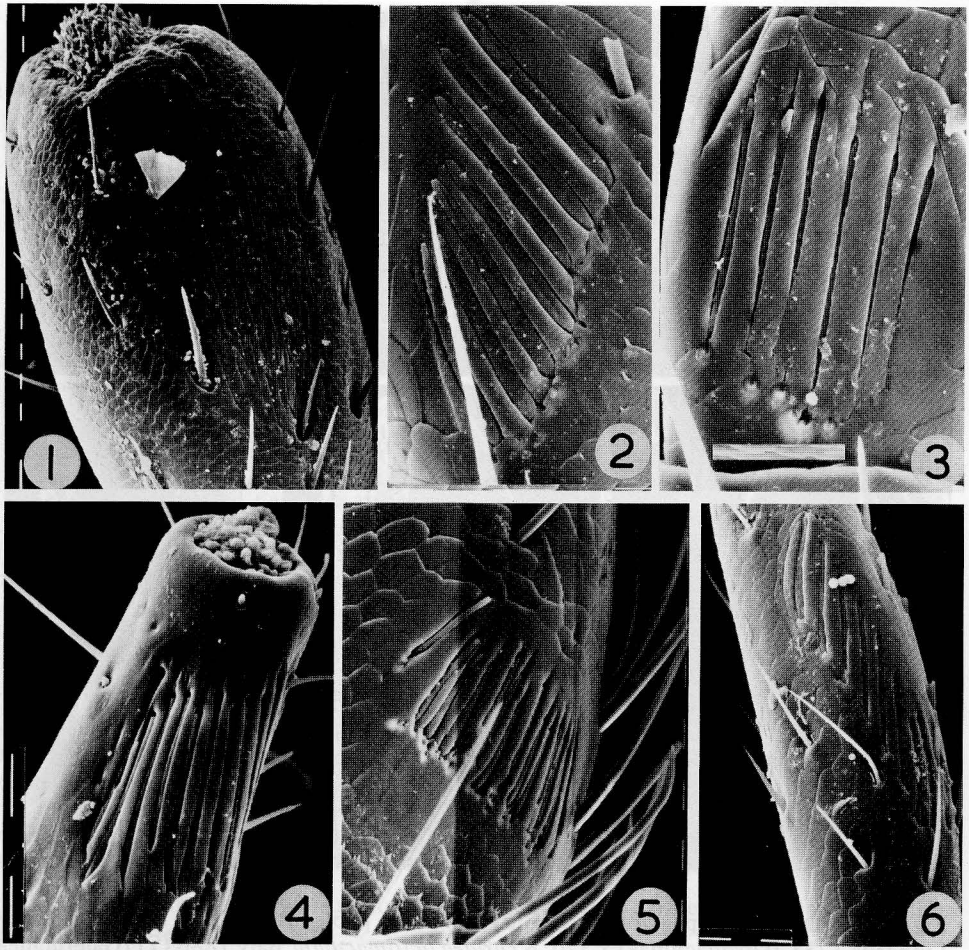

Fig 1–6: Digitiform pegs of adult Chrysomeloidea [Coleoptera]. – **1** *Rhagium bifasciatum* Von Linné 1775 (♀) [Cerambycidae: Lepturinae] x 320; **2** *Colasposoma semicostatum* Jacoby 1908 (♀) [Chrysomelidae: Eumolpinae] x 1250; **3** *Eubrachis indica* Baly 1878 (♂) [Chrysomelidae: Eumolpinae] x 1250; **4** *Leiopus nebulosus* Linnaeus 1758 (♀) [Cerambycidae: Lamiinae] x 1250; **5** *Chrysolina exanthematica* Weidemann 1821 [Chrysomelidae: Chrysomelinae] x 640; **6** *Nodina crassipes* Jacoby 1908 [Chrysomelidae: Eumolpinae] x 640.

than the ♂♂ in *Aulacophora foveicollis* Lucas 1849, *Galerucida rutilans* Hope 1831, *Merista quadrifasciata* Hope 1831, *Mimastra oblonga* Gyllenhall 1808, *M. quadripartita* Baly 1879, *Monolepta signata* Olivier 1808 and *Sphenoraia bicolor* Hope 1831 (Tab I).

3.3.4 Subfamilia Halticinae (Fig 23, 26)

The position and arrangement of sensilla is as in Galerucinae. The sensilla lie in shallow grooves and in some cases [e g in *Hyphasoma nigrocorne* Baly 1878 and *Derocrepis ru-*

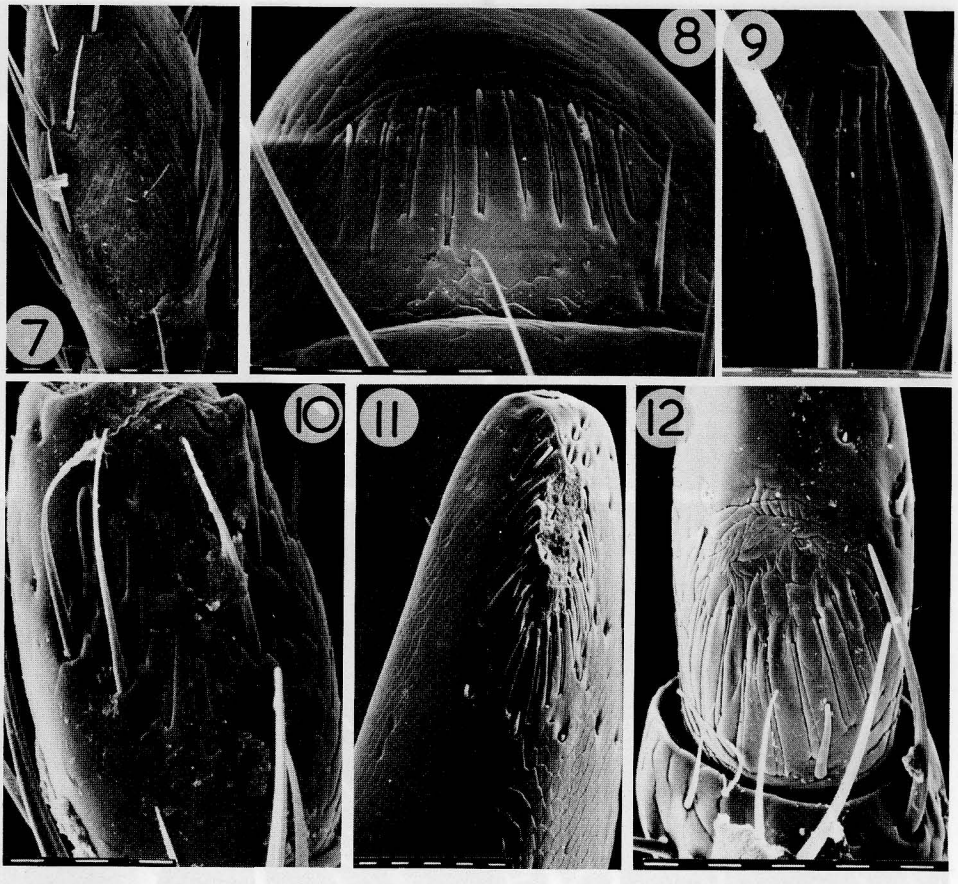

Fig 7–12: Digitiform pegs of adult Chrysomelidae [Coleoptera]. – **7** *Orsodacne cerasi* Linnaeus 1758 [Orsodacninae] x 320; **8** *Paridea octomaculata* Baly 1886 (♀) [Galerucinea] x 640; **9** *Lema coromandeliana* Fabricius 1798 (♀) [Criocerinae] x 1250; **10** *Syneta betulae* Fabricius 1792 (♀) [Synetinae] x 640; **11** *Sagra adonis* Lacordaire 1845 [Sagrinae] x 320; **12** *Plateumaris discolor* Panzer 1795 (♂) [Donaciinae] x 640.

fipes Linnaeus 1758] their tips project out of the grooves. The number of sensilla may vary between the sexes, and if so, is more in ♂♂ than ♀♀ [e g in *Haltica cyanaea* Weber 1801, *Hyphasoma nigricorne* and *Derocrepis rufipes*] (Tab I).

3.3.5 Subfamilia Eumolpinae (Fig 2, 3, 6)

In the representatives studied here, the sensilla are situated in the lower half of the segment. They are set in an oblique [e g in *Colasposoma semicostatum* Jacoby 1908 and *Nodina crassipes* Jacoby 1908] or wide transverse curve [e g in *Colasposoma asperatum* Lefevre 1885, *Corynodes peregrinus* Herbst 1783, *Eubrachis indica* Baly 1878 and *Basilepta variabile* Duvivier 1892]. They may be deeply sunk [as in *Eubrachis indica*], or lie in shallow grooves [e g in rest of the species studied]. There are numerous sensilla campaniformes at the base of each digitiform organ.

3.3.6 Subfamilia Chrysomelinae (Fig 5)

The sensilla are situated at the base of the segment in a shallow transverse curve with their tips pointing towards the apex of the segment. They lie in shallow grooves and have numerous sensilla campaniformes at their bases [e g in *Chrysolina exanthematica* Weidemann 1821, *Ch. polita* Linnaeus 1758, *Ch. varians* Schaller 1783, *Gastroidea viridula* DeGeer 1775, *Phaedon tumidulus* Germar 1824 and *Phyllodecta vulgatissima* Linnaeus 1758]. In *Timarcha tenebricosa* Fabricius 1775 there is a similarly arranged group of about 20 sensilla near the apex of the segment.

3.3.7 Subfamilia Aulacoscelinae

In *Aulacoscelis melanocera* Stål 1863, the sensilla are situated near the base of the segment and are arranged in a shallow transverse curve. They lie in shallow grooves with their tips directed towards the apex of the segment.

3.3.8 Subfamilia Sagrinae (Fig 11)

The sensilla are situated near the apex of the segment in *Sagra femorata* Doury 1773 and *S. adonis* Lacordaire 1845 and in the middle in *Megamerus kingi* McLeay 1827. The sensilla lie in deep grooves and are set in a U-shaped pattern in *S. femorata* and *M. kingi* and in shallow transverse curve in *S. adonis*.

3.3.9 Subfamilia Donaciinae (Fig 12, 18)

The sensilla lie deeply sunk in the cuticular grooves and are grouped in a row e g in *Sominella macrocnemia* Fischer 1824 or shallow transverse curve at the base of the segment [e g in *Sominella longicornis* Jacoby 1890, *Plateumaris discolor* Panzer 1795 and *Donacia crassipes* Fabricius 1775]. There are no apparently visible sensilla in *Macroplea appendiculata* Panzer 1794. The tips of the sensilla in the rest of the species studied are directed towards the apex of the segment. There are only 2 sensilla in the ♀♀ of *Donacia crassipes*, 10–12 in *P. discolor* and 6–9 in *S. macrocnemia* and *S. longicornis*.

It appears that the species with a more aquatic mode of life have fewer sensilla than the ones with more terrestrial habits.

3.3.10 Subfamiliae Hispinae-Cassidinae (Fig 17, 20, 21)

In the representatives of these 2 subfamiliae studied here, the sensilla are situated near or at the base of the segment and are arranged in a shallow transverse curve. They lie in shallow grooves as in *Dactylispa peregrina* Maulik 1919, *Cassida flaveola* Thunberg 1794, *Glyphocassis trilineata* Hope 1831 and *Laccoptera nepalensis* Boheman 1855.

3.3.11 Subfamilia Criocerinae (Fig 9)

The sensilla are deeply sunk in the grooves and lie at the base of the segment in the species of the genera *Lema* and *Oulema* studied here. They are set parallel to each other in a transverse line and their tips are directed towards the apex of the segment. There are one or many sensilla campaniformes at the base of each digitiform peg. The number of sensilla varies in each species and ranges from 4–7 in the species studied.

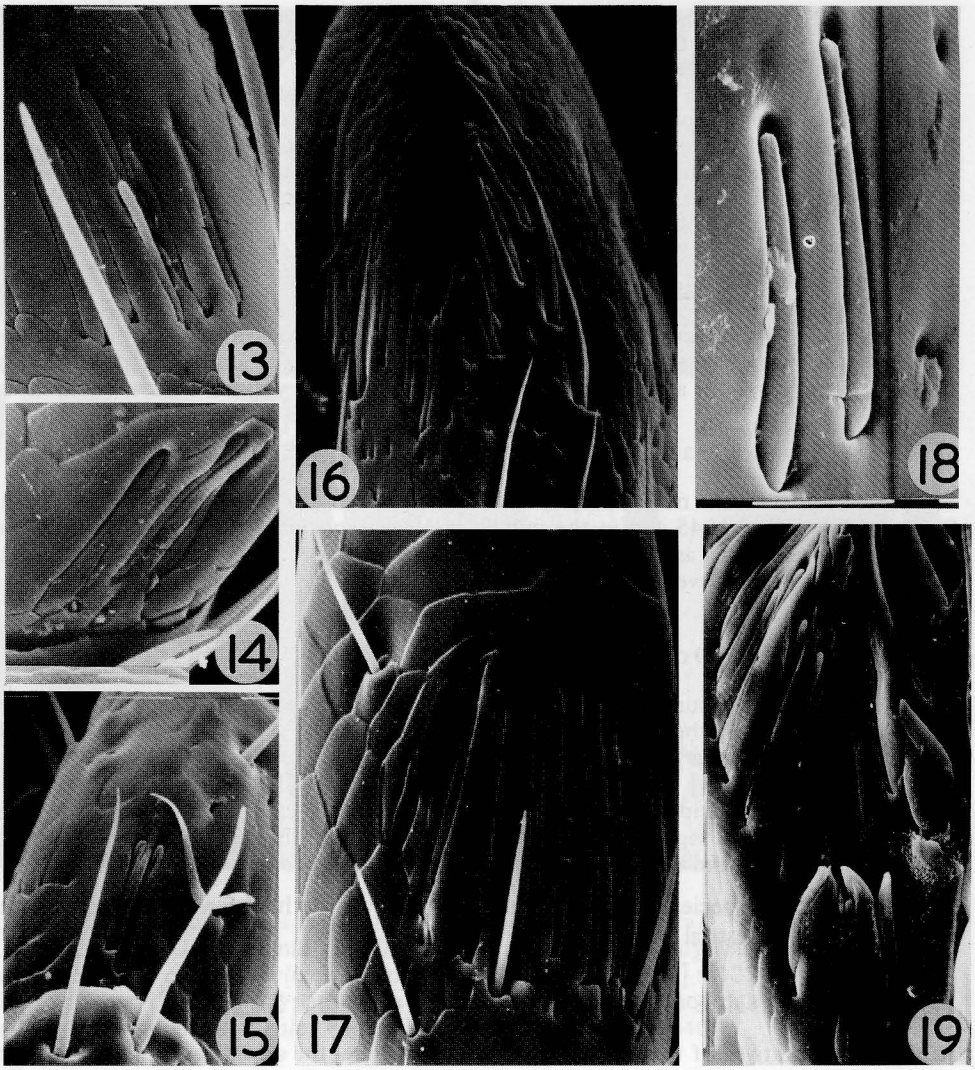

Fig 13–19: Digitiform pegs of adult Chrysomelidae [Coleoptera]. – **13** *Diapromorpha turcica* Fabricius 1801 (♀) [Clytrinae] x 1250; **14** *Oomorphus concolor* Sturm 1807 (♀) [Lamprosominae]; **15** *Cryptocephalus labiatus* Von Linne 1761 [Cryptocephalinae] x 2500; **16** *Fulcidax monstrosus* Fabricius 1798 (♀) [Chlamisinae] x 640; **17** *Glyphocassis trilineata* Hope 1831 [Cassidinae] x 1250; **18** *Donacia crassipes* Fabricius 1775 [Donaciinae] x 2500; **19** *Sphondylia afra* Klug 1824 [Megalopodinae] x 1250.

3.3.12 Subfamilia Megalopodinae (Fig 19, 24)

The sensilla lie deeply sunk in the grooves and are arranged in an elongate U-shaped pattern, occupying most of the outer side of the segment in *Sphondylia afra* Klug 1824, *Mucromegalopus buckleyi* Jacoby 1889, *M. armatus* Lacordaire 1845, *Megalopus inscriptus* Klug 1824, *Leucastea dohrni* Stål 1855, *Temnaspis cumingi* Westwood 1864 and *Ateledera cygnoides* Lacordaire 1845 and at the base of the segment in *Mastostethus nigricinctus* Chevrolat 1832. The tips of the sensilla are directed inwards and upwards towards the central axis of the U-shaped pattern. At the base of the pattern a couple of thick structures with finger-like processes at their tips are present in *S. afra* (Fig 19). We presume them to be sensory in nature. The bases of the sensilla are surrounded by the pores of numerous campaniform sensilla.

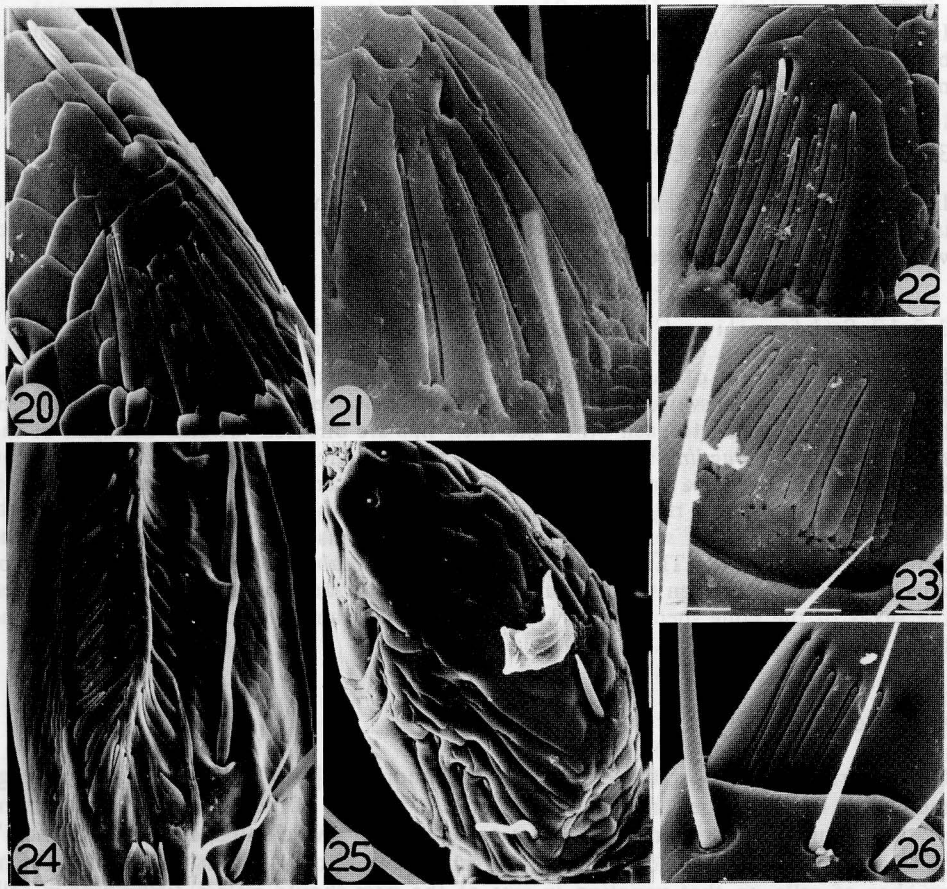

Fig 20–26: Digitiform pegs of adult Chrysomelidae [Coleoptera]. – **20** *Laccoptera nepalensis* Boheman 1855 [Cassidinae] x 1250; **21** *Dactylispa peregrina* Maulik 1919 (♂) [Hispinae] x 1250; **22** *Monolepta signata* Olivier 1808 (♂) [Galerucinae] x 1250; **23** *Haltica cyanea* Weber 1801 (♂) [Halticinae] x 1250; **24** *Sphondylia afra* Klug 1824 [Megalopodinae] x 640; **25** *Zeugophora flavicollis* Marsham 1802 (♀) [Megalopodinae] x 1250; **26** *Luperomorpha nigripennis* Duvivier 1802 (♀) [Halticinae] x 1250.

3.3.13 Subfamilia Zeugophorinae (Fig 25)

In *Zeugophora flavicollis* Marsham 1802, 8–10 sensilla are grouped in a shallow transverse curve near the base of the segment. They lie deeply sunk in the grooves and their tips are directed towards the central axis of the pattern (Fig 25).

3.3.14 Subfamilia Megascelinae

In *Megascelis flavipes* Lacordaire 1845, 8–10 sensilla are set in a shallow transverse curve in the middle of the segment. The tips of the sensilla are directed towards the apex of the segment.

3.3.15 Subfamilia Lamprosomatinae (Fig 14)

In *Oomorphus concolor* Sturm 1807, there are 3 sensilla resting in shallow grooves at the base of the segment (Fig 14). It is presumed that the small size of the beetle affects the number of sensilla on the segment.

3.3.16 Subfamilia Chlamisinae (Fig 16)

In *Fulcidax monstrosus* Fabricius 1798, the sensilla are numerous and irregularly arranged in the middle of the segment. They lie in shallow grooves and their tips are directed towards the apex of the segment.

3.3.17 Subfamiliae Clytrinae-Cryptocephalinae (Fig 13, 15)

In the representatives of the 2 groups studied here, the sensilla are situated at the base of the segment, in a transverse line or in a shallow transverse curve. In the former pattern, the sensilla lie parallel to each other and their tips are directed towards the apex of the segment as in *Smaragdina* sp., *Cryptocephalus divisus* Jacoby 1903 and *C. labiatus* Von Linné 1761. The sensilla are deeply sunk in the grooves, and the cuticular surface in their vicinity is without any ridges and grooves as found in the representatives of other subfamiliae. The number of sensilla present in a species seems to be related to the size of the individuals in a species. There are only 2 sensilla in *C. labiatus* (Fig 15). The number of sensilla may vary between the right and left palp of the same individual and also between the sexes of the same species (Tab 1). Several sensilla campaniformes are present at the base of each digitiform peg.

4 Systematic and Functional Conclusions

Our observations support the conclusion of Honomichl [1980] that the digitiform pegs tend to be of about the same size, irrespective of the size of the beetle or of the segment of the palpus maxillaris on which they are situated – which suggests, as Honomichl's histological observations do, that these organs may be formed by a fixed and constant number of cells, so that variation in size of the pegs should reflect differences in cell-size between species. We also agree with this author's suggestion that the number of pegs tends to be higher in larger species (Tab 1).

The main possibly functional correlations we have noted are that the number of pegs tends to be reduced in aquatic species – e g in *Macroplea* and *Donacia* as compared with the more terrestrial *Plateumaris* or similar-sized Criocerinae, and that actively flying and floricolous species tend to have the pegs arranged in a characteristic fashion, forming an

Tab 1: Examined species of Longicorn Beetles and Leaf Beetles [Coleoptera: Chrysomeloidea].

Familia Subfamilia Genus specius	Sex	No & Size of sensilla (No)	(u m)	Length of apical segment of palpus (mm)	Whole body length (mm)
I. Cerambycinae					
1. Cerambycinae					
Rhagium bifasciatum Fabricius 1775	♀	Numerous	45	0.545	18.43
2. Lamiinae					
Leiopus nebulosus Linnaeus 1758	♀	10	31	0.238	5–9
II. Chrysomelidae					
1. Orsodacninae					
Orsodacne cerasi Linnaeus 1758	♀	27	43	0.231	4.5–8
2. Synetinae					
Syneta betulae Fabricius 1792	♂	10	28	0.165	5.82
3. Eumolpinae					
Colasposoma asperatum Lefevre 1885	♂	7	35–37	0.198	4.12
Colasposoma semicostatum Jacoby 1908	♂	6	40	0.23	4.5–5
Corynodes peregrinus Herbst 1783	♀	8	47	0.264	9–12
Basilepta variable Duvivier 1892	♀	7.10	40	0.198	4–5
Eubrachis indica Baly 1878	♂ ♀	6–7 9	40	0.195	3–4
Nodina crassipes Jacoby 1908	–	8	37	0.2112	2.75
4. Galerucinae					
Aulacophora foveicollis Lucas 1849	♂ ♀	8 12–13	21 28–30	0.175	5.82 7.32
Exosoma lusitanica Linnaeus 1767	♂	7	31	0.231	8.73
Galerucida rutilans Hope 1831	♂ ♀	5–6 11–12	30 40	0.142	8.5–9
Lochmaea suturalis Thomson 1866	♂ ♀	8	20	0.099	4.5–5
Luperus longicornis Fabricius 1781	♀	4	34	0.119	3–4
Macrima armata Baly 1878	♂	11–12	55.4	0.2	7
Merista quadrifasciata Hope 1831	♂ ♀	10 11	31 40	0.198	13
Mimastra oblonga Gyllenhall 1808	♂ ♀	5–6 7–11	38 40	0.175	8.73 9.94
Mimastra quadripartita Baly 1879	♂ ♀	7 7–8	30 40	0.165	7.03 8.23