POLSKIE PISMO ENTOMOLOGICZNE
BULLETIN ENTOMOLOGIQUE DE LA POLOGNE

Tom XXIII Wrocław 1953 Nr 9

Unerwienie i narządy zmysłowe skrzydeł pilarzy: *Allantus arcuatus* Forst. i *Rhogogaster viridis* L. (*Hymenoptera, Tenthredinoidea*)

Иннèрвация и органы чувств крыльев пилильщиков: *Allantus arcuatus* Forst. и *Rhogogaster viridis* L. (*Hymenoptera, Tenthredinoidea*)

The innervation and sense organs in the wings of the Saw-flies: *Allantus arcuatus* Forst. and *Rhogogaster viridis* L. (*Hymenoptera, Tenthredinoidea*)

napisała

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Introduction

The innervation and sense organs of *Hymenoptera* have been several times investigated. Vogel described the olfactory and taste organs in bees and wasps; Erhardt and Zaćwilichowski investigated the innervation and sense organs in the wings of these insects. On the other hand the suborder *Tenthredinoidea* was not examined till to-day. Zaćwilichowski described the innervation and sense organs in the ovipositor of *Allantus arcuatus* Forst., but the nerve elements in the wings of *Tenthredinoidea* are little known.

In my investigation I intended to work out the innervation and sense organs in the wings of the Saw-flies, because the suborder *Tenthredinoidea* as the most primitive group of *Hymenoptera*, may bear as well some resemblances to, as show some differences from the Stinging *Hymenoptera*.

I took over the names of the veinlets in the wings from Comstock, and the names of the chitinous plates at the base of wings — from Zaćwilichowski.

Material and methods

As research material I used specimens of the Saw-flies: *Allantus arcuatus* Forst. and *Rhogogaster viridis* L. These specimens were stained with methylene-blue injected into their thorax near the base of their wings; then they were fixed with molybdate of ammonia. Having washed out the excess of ammonia with water and dehydrated the wings of the Saw-flies by passing them through absolute alcohol I left them for some time in cedarwood oil. Then I removed superfluous remainders of thoracic chitin affixed to the wings and closed the latter on an objectglass in Canada balsam.

Anterior wing

The anterior wings of the Saw-flies: *Allantus arcuatus* Forst. and *Rhogogaster viridis* L. are about 1 cm long and the innervation in both species in question is very similar (fig. 1). The

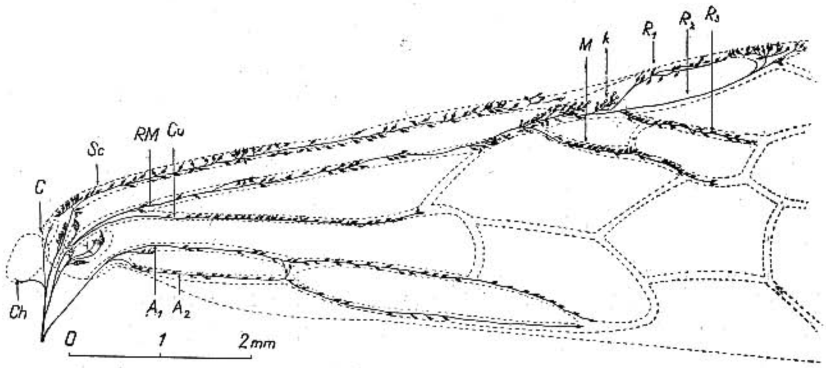

Fig. 1. Proximal and medial part of the anterior wing of the Saw-fly *Allantus arcuatus* Forst. *Ch* — *nervus chordotonalis antealaris*, *C* — *n. costalis*, *Sc* — *n. subcostalis*, *RM* — *n. radio-medialis*, *Cu* — *n. cubitalis*, *M* — *n. medialis*, R_1 — *ramus radialis* I, R_2 — *ramus radialis* II, R_3 — *ramus radialis* III, A_1 — *ramus analis* I, A_2 — *ramus analis* II, *k* — *pores.*

costal veinlet is reduced and blended with the subcostal one. The radial, medial and cubital veinlets form at the base of the wing a collective vein R+M+Cu; Cu detaches itself from this vein at a little distance from the base, but M remains blended with R and gets detached from it only just before the pterostigma. The pterostigma is big, distinct and hardened strongly enough. In the anal lobe of the wing appear two anal veinlets.

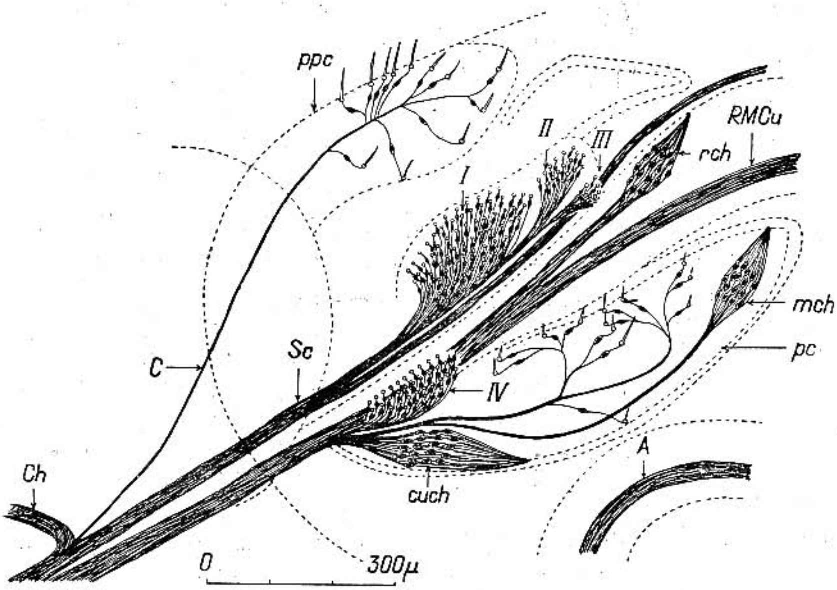

Fig. 2. Base of the anterior wing of the Saw-fly. *ppc* — praecostal plate, *pc* — costal plate, I, II, III — three subcostal groups of pores, IV — radial group of pores. Chordotonal organs: *rch* — radial, *mch* — medial, *cuch* — cubital. *Ch* — *n. chordotonalis antealaris*, *C* — *n. costalis*, *RM* — *n. radio-medialis*, *Cu* — *n. cubitalis*, R_1 — *n. radialis primus*,

At the base of the wing (fig. 2) the praecostal plate appears distinctly divided into three sclerits, two of which lie on the upper surface and the third on the lower surface of the wing. The costal plate, however, is situated between the veinlets: R+M+Cu and A_1, and appears as an uniform narrow and elongate formation.

The tegula (fig. 3) adheres to the place, where the wing sticks to the thoracic chitin; it is a chitinous plate, about 800μ long and 500—550μ wide and provided like the wing with sense organs and nerve elements.

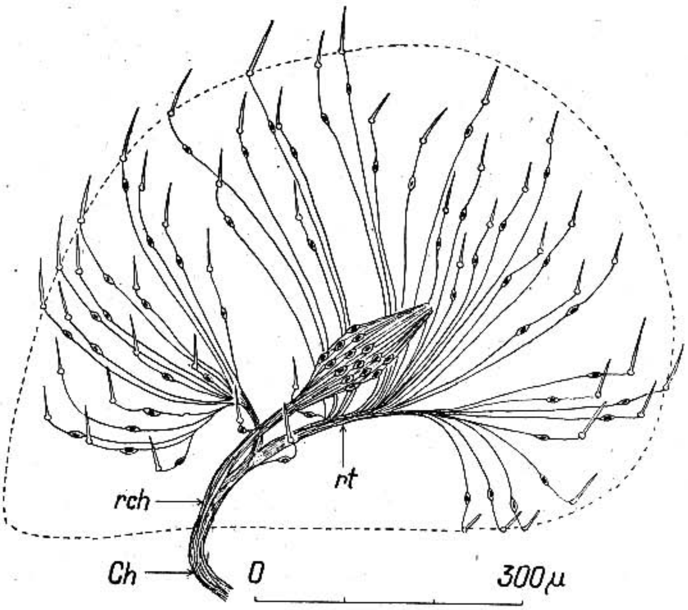

Fig. 3. Tegula of the Saw-fly. *Ch* — *n. chordotonalis antealaris, rch* — *ramus chordotonalis, rt* — *ramus tegularis.*

Sense organs

In the anterior wing of the Saw-flies: *Allantus arcuatus* Forst. and *Rhogogaster viridis* L. sense organs appear as sense hairs (*sensillae trichoideae*), pores (*sensillae campaniformes*) and chordotonal organs.

The sense hairs are built of chitin which forms also a thick ring at the base of the hair. The size of hairs varies, the smallest being about 20 μ long and the biggest — about 65 μ long; the average length of hairs is, however, about 43 μ. Hairs appear on the wings in a great number, but only some of them are sense organs. Every sense hair is innervated by a process of a single sensory-nerve cell. This process goes to the basal ring; I call it the cellulipetal process, because it transfers sensory impressions from a sense organ, in this case from a hair, to the sensory-nerve cell. The other process of this cell joins the processes of the other cells, thus forming a nerve branchlet and transfers sensory impressions from the sensory-nerve cell to a nerve-centre; therefore I call it the cellulifugal process.

The sense hairs appear on the tegula, on the praecostal and costal plates, on the veinlets and on the wing membrane in the immediate neighbourhood of the veinlets.

The pores are also built of chitin which forms a thin membrane surrounded by a thicker round chitinous ring. The diameter of a pore measures about 8 μ. The pores appear at the base of the wing and on the veinlets: R+M and R. At the base of the wing they form groups of pores. Three groups are placed on the lower sclerit of the praecostal plate; they are innervated by branchlets of the subcostal nerve, and therefore are called the subcostal groups of pores, like those in the wings of the honey-bee. The first group occupying a rather large part of the surface of the sclerit is the most numerous one: it is formed by over 70 pores, which lie rather near to each other. The second subcostal group consists of over 20 pores and the third group of 7—10 pores; both groups lie in the distal part of the sclerit.

Besides these groups there is also at the base of the wing a group of pores which corresponds to the radial group in the honey-bee; it lies on the upper surface of the wing before the collective vein R+M+Cu, near the proximal part of the costal plate. It consists of about 40 pores innervated by branchlets of the nerve R+M+Cu; the branchlets part from the collective trunk, not far behind the place, where from runs off the branch, which innervates the costal plate.

The pores belonging to the first and second subcostal groups and to the radial group show at their base a pore canal, the length of which corresponds usually to the double length of the diameter of the pore. Similar canals have already been described in other insects (by Fudalewicz-Niemczyk o w a in *Locusta cantans* Füssl. and by Z a ć w i l i c h o w s k i in *Apis mellifica* L.). I did not find, however, any canal under the pores of the third subcostal group.

Besides these groups the pores are also situated on the short section of the veinlet R+M, just before the veinlet M goes off, and on the veinlet R before it joins the pterostigma. On these veinlets the pores do not form any groups but appear separately, about six of them on the veinlet R+M and about 20 — 25 on the veinlet R. These pores are deprived of canals. I did not find any pores on the tegula.

As the sense hairs so every pore is innervated by the cellulipetal process of a single sensory-nerve cell, which lies at a little distance from the pore.

T h e c h o r d o t o n a l o r g a n s appear exclusively at the base of the wing (the radial, medial and cubital chordotonal organs), and in the tegula (the tegular or antealar chordotonal organ).

The radial chordotonal organ lies between the veinlet Sc and the third subcostal group of pores. It is innervated by long nerve fibres starting from the collective nerve R+M+Cu, and its cellulipetal processes are affixed to the chitin of the wing close to the veinlet Sc.

The organs corresponding to the medial and cubital chordotonal organs of other insects are placed in the costal plate. The cubital chordotonal organ lies in the proximal part of the plate, and is innervated by a thick bundle of nerve fibres which run off from the collective trunk R+M+Cu. The cellulipetal fibres of this organ are attached to the margin of the plate. The medial chordotonal organ is located in the proximal part of the costal plate. It is innervated by a long and relatively thin bundle of fibres, which runs off from the collective nerve R+M+Cu very near to the place, where from goes off the nerve of the cubital chordotonal organ. The cellulipetal fibres of the medial chordotonal organ are affixed to the distal part of the costal plate.

The tegular or antealar chordotonal organ lies nearly in the middle of the tegula. It is innervated by a branch of the antealar chordotonal nerve, and its cellulipetal nerve fibres are affixed to the chitin of the tegula.

Besides sense hairs, pores and chordotonal organs I found no other sense organs in the anterior wing of the Saw-flies.

Innervation of the anterior wing

The anterior wing of the Saw-flies is innervated by the anterior alar nerve (*nervus alaris anterior*), which even before penetrating into the wing divides the anal nerve (*n. analis*) and then splits into two branches. One of these splits (before penetrating into the wing) into the thick antealar chordotonal nerve (*n. chordotonalis antealaris*), the thin costal nerve (*n. costalis*) and the thick subcostal nerve (*n. subcostalis*). The other branch penetrates into the wing and there becomes divided.

The antealar chordotonal nerve (*n. chordotonalis antealaris*) is a thick uniform trunk which penetrates into the tegula and splits there into two branches: the chordotonal and the tegular. The chordotonal branch (*ramus chordotonalis*) innervates the tegular chordotonal organ without sending off any branchlets. On the other hand the tegular branch (*ramus tegularis*) divides into two smaller branchlets which next split into long nerve fibres. The fibres reach the big distinct sensory-nerve cells as their cellulifugal processes. The cellulipetal processes of these cells innervate the numerous sense hairs on the tegula.

The costal nerve (*n. costalis*) is a thin nerve branchlet, which after getting split runs through the base of the wing and penetrates into the upper sclerit of the praecostal plate; this sclerit lies close to the margin of the wing. In the sclerit the costal nerve splits into nerve fibres, which run to the sensory-nerve cells. These cells innervate the twelve sense hairs placed on the above-mentioned sclerit.

The subcostal nerve (*n. subcostalis*) penetrates into the wing, and at its base splits off a thick branch which runs to the lower sclerit of the subcostal plate. There, the branch sends off numerous nerve fibres connected with sensory-nerve cells which innervate the first subcostal group of pores. The branch itself runs a little further on innervating in the same manner the second and the third subcostal group of pores. The remaining part of the subcostal nerve penetrates into the veinlet Sc and runs in it to its end, i. e. to the beginning of the pterostigma. In its course the subcostal nerve splits off numerous thin nerve fibres which innervate over 80 sense hairs on veinlet Sc by means of the sensory-nerve cells.

The second branch of the alar nerve is a thick collective radio-medio-cubital nerve (*n. radio-medio-cubitalis*). After penetrating into the wing this nerve splits off two bundles of fibres which innervate the sense organs of the costal plate. One of these bundles reaches the cells of the cubital chordotonal organ which lies in the proximal part of the costal plate. The other bundle separates into two smaller bundles; one of them innervates the cells of the medial chordotonal organ in the distal part of the plate, and the other splits into nerve fibres, more or less in the central part of the plate. The fibres are the cellulifugal processes of the sensory-nerve cells which innervate twelve smaller and a single bigger sense hair on the costal plate.

Very near to the place, where the above-described bundles of fibres split off, small nerve fibres also separate from the collective nerve; by means of the sensory-nerve cells they innervate the radial group of pores which lies close to the upper surface of the sclerit.

A little further, the radio-medio-cubital nerve splits off a thick and rather long bundle of nerve fibres which run beyond the vein R+M+Cu and innervate the cells of the radial chordotonal organ. Further on this nerve goes in the vein R + M + Cu. Where the cubital veinlet (Cu) separates from the collective vein, there it receives a bundle of fibres that form the cubital nerve (*n. cubitalis*). The remaining fibres constitute the radio-medial nerve (*n. radio-medialis*); this nerve runs in the veinlet R + M and sends off fibres beyond the limits of this veinlet. These fibres, as well as the fibres which also split off from the radio-medial nerve but remain in the veinlet R+M, innervate the numerous sense hairs lying on the veinlet or immediately in its vicinity. However, in the final section of the veinlet R + M, the scarce fibres innervate by means of sensory-nerve cells six sense pores which appear on that part of the veinlet, but do not innervate any hairs.

In the place where the veinlet M goes off the medial nerve (*n. medialis*) also splits off. The remaining part of the fibres forms the radial nerve (*n. radialis*), which penetrates into the pterostigma and divides into three branches. Before dividing, however, the radial nerve sends off small nerve fibres to the cells, which innervate a single hair and over twenty sense pores.

In the pterostigma the radial nerve splits into three branches: the first, second and third (*rami radiales*: I, II *et* III).

The first radial branch goes along the anterior margin of the pterostigma from the distance of more or less $^2/_5$ to $^4/_5$ of its length. In its course small fibres separate from it innervating about sixteen small sense hairs by means of sensory-nerve cells.

The second radial branch runs in the pterostigma along its posterior margin, and in its course splits off only a single fibre which joins the sensory-nerve cell innervating one sense hair. It is only in the distal part of the pterostigma that the second radial branch divides into numerous small nerve fibres; these are cellulifugal processes of the sensory-nerve cells which innervate about twenty small sense hairs. These hairs lie in the distal part of the pterostigma and in the proximal part of the veinlet R_1.

Shortly after getting separated the third radial branch penetrates into the veinlet R_3, and runs in it as far as the transversal veinlet which divides the second medial cell from the third. In its course this branch sends off numerous small fibres innervating the sense hairs placed on the veinlet R_3 by means of the sensory-nerve cells.

The medial nerve (*n. medialis*) after splitting from the collective radio-medial nerve, runs in the veinlet M, more or less parallel to the third radial branch, and extends almost as far as this branch. In its course it also emits numerous small fibres, which are the cellulifugal processes of the sensory-nerve cells innervating the small hairs on the veinlet M.

The cubital nerve *(n. cubitalis)* separates immediately behind the base of the wing from the radio-medio-cubital nerve and runs in the veinlet Cu as far as the transversal veinlet which divides the first and the second cubital cells. On this part of the veinlet Cu appear numerous, very small or bigger sense hairs; these are innervated by the sensory-nerve cells, whose cellulifugal processes join the cubital nerve.

The anal nerve *(n. analis)* separates from the alar nerve already in the thorax and penetrates into the wing, into the anal veinlet. Just behind the base of the wing this veinlet divides into two veinlets: A_1 and A_2 and analogously the anal nerve splits into two branches: the first and the second (*ramus analis primus et. ramus analis secundus*), which run in the corresponding veinlets up to their end. In their course both branches give off fibres which innervate by means of sensory-nerve cells the sense hairs placed on both anal veinlets.

In more or less $^1/_3$ of the distance from the base of the wing the veinlets: A_1 and A_2 are connected with each other by a short transversal veinlet. In the wings of the species *Rhogogaster viridis* L. no nerve elements appear in the transversal veinlet, and the branches of the anal nerve are not connected with each other; but in the wings of *Allantus arcuatus* Forst. a transversal nerve branchlet, which runs in the transversal veinlet, joins both anal branches. This branchlet also sends off some fibres which innervate by means of sensory-nerve cells the scarce sense hairs placed on the transversal veinlet.

Posterior wing

The innervation of the posterior wing of the Saw-flies shows some analogies to that of the anterior wing (fig. 4). As in the anterior wing so the veinlet C of the posterior wing is merged in the veinlet Sc. The latter joins the veinlet R in more or less $^1/_2$ of the length of the wing, and the part of the veinlet R, which lies immediately behind their junction and is about 1,5 mm long, is provided with two rows of long chitinous hooks *(hamuli)*.

The veinlets: R, M and Cu have a common base; the veinlet Cu separates from it just behind the base of the wing; the collective veinlet R+M runs further on, and in approximately $^1/_2$ of the length of the wing divides into the veinlets: R_{1+2}, R_3, and M.

In the anal lobe are three anal veinlets.

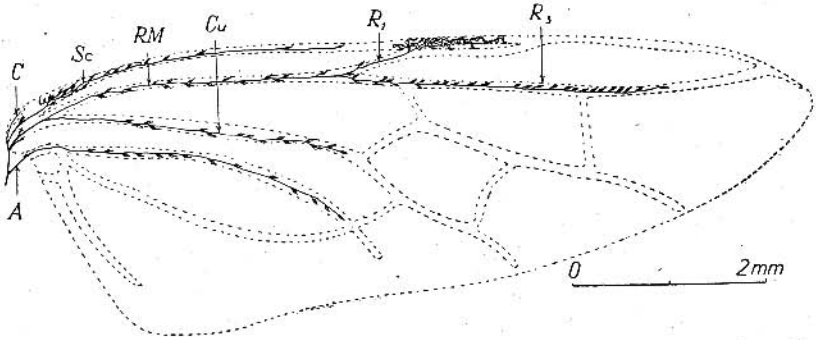

Fig. 4. Posterior wing of the Saw-fly. C — *n. costalis*, Sc — *n. subcostalis*, RM — *n. radio-medialis*, Cu — *n. cubitalis*, R_1 — *n. radialis primus*, R_2 — *n. radialis secundus*, A — *n. analis*.

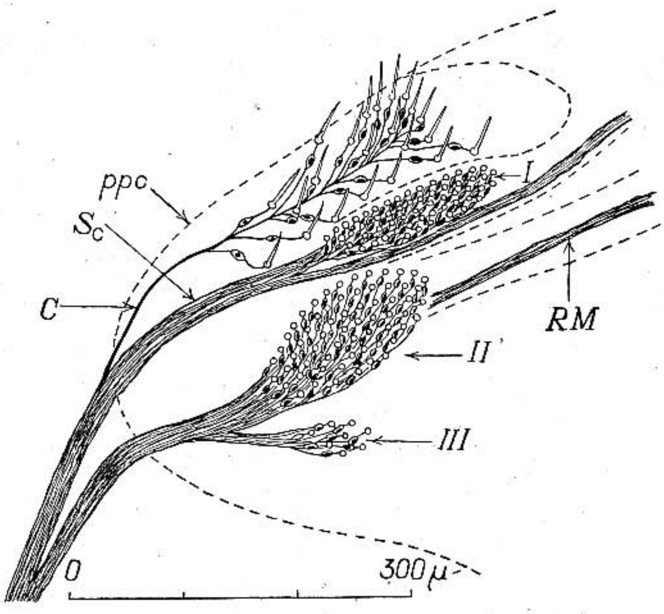

Fig. 5. Base of the posterior wing of the Saw-fly. *ppc* — praecostal plate, I — subcostal group of pores, II, III — radial groups of pores, C — *n. costalis*, Sc — *n. subcostalis*, RM — *n. radio-medialis*.

Between the anterior margin of the wing and the veinlet Sc, near the base of the wing (fig. 5), there is a little chitinous plate corresponding to the praecostal plate in the anterior wing; in the posterior wing, however, there are no chitinous formations which would correspond to the costal plate or to the tegula of the anterior wing.

Sense organs

The sense organs in the posterior wing of the Saw-flies appear in the shape of sense hairs (*sensillae trichoideae*), pores (*sensillae campaniformes*) and hooks (*hamuli*).

The sense hairs on the posterior wing are developed, innervated and fixed to the surface of the posterior wing similarly as the hairs on the anterior wing, but in comparison with the latter they are of nearly uniform size, as their length amounts to 30 — 45 μ. Besides the sense hairs on the posterior wing appears a great number of hairs, which are not provided with nerve elements, and which are placed as well on the veinlets as on the wing membrane. The sense hairs appear only on the veinlets and on the praecostal plate.

The pores on the posterior wing resemble in appearance, size and manner of innervation the pores of the anterior wing, but differ from the latter by their localisation on the wing. The pores of the posterior wing are assembled in three groups, which lie at the base of the wing. The first of these groups is placed on the lower surface of the wing, between the praecostal plate and the veinlet Sc and consists of 50 — 70 pores, densely arranged. This group corresponds to the subcostal group in the wings of the honey-bee, as, like the latter, it is innervated by the subcostal nerve.

The two other groups of pores are joined by the nerve elements derived from the collective nerve R+M+Cu and therefore correspond to the radial groups in the wings of the honey-bee. The radial groups of the Saw-flies are placed on the upper surface of the wing; the first of them lies at the base of the collective vein R+M+Cu, the second a little nearer to the posterior margin of the wing and nearer to the veinlet A_1. The first group consists of 50 — 70 pores, and the second group counts 6 — 10 pores; in both groups the pores do not accumulate but lie loosely every one of them being situated at some distance from its neighbours.

All the pores of the posterior wing are provided with canals.

Besides these groups I found on the posterior wing of the Saw-flies neither other groups of pores nor single pores.

T h e h o o k s. On the posterior wing the big chitinous hooks (fig. 6) appear on the veinlet R_1 from its beginning up to its junction with the veinlet R_2. The length of the hooks

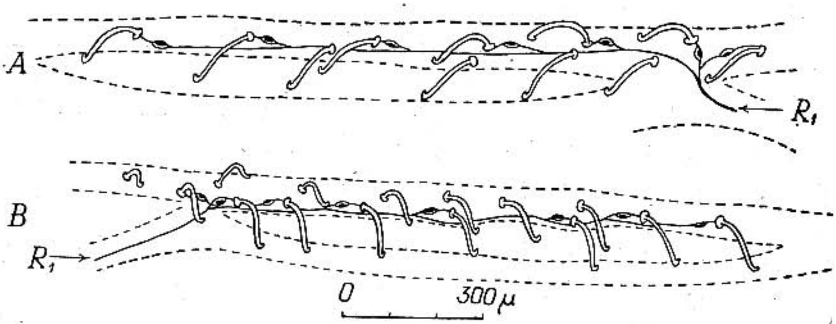

Fig. 6. Innervation of the hooks on the posterior wings of the Saw-flies: *A* — *Allantus arcuatus* Forst., *B* — *Rhogogaster viridis* L. R_1 — *n. radialis primus.*

reaches 150—190 μ; they are built of thick, dark-brown chitin and are slightly bent in the basal part, and on their end strongly crooked like a crochet-needle. Every hook is placed in a rather ample cavity of light-yellow chitin. The cellulipetal process of the sensory-nerve cell arrives to this cavity. The cell itself joins through the medium of its cellulifugal process the first radial nerve. The hooks are arranged in two rows which lie very near each other and are more or less parallel to the margin of the wing; every row consists of nine to eighteen hooks, but most often of thirteen hooks. On both ends of the rows, i. e. at the beginning and at the end of the veinlet R_1, the hooks distinctly tend to merge into one row.

I did not find, however, in the posterior wing of the Sawflies any chordotonal organs nor any other sense organs, except the above-described.

Innervation of the posterior wing

The posterior wing is innervated by the posterior alar nerve (*n. alaris posterior*) which divides into two branches before penetrating into this wing. The first branch consists of the costo-subcostal nerve (*n. costo-subcostalis*) and of the radio-medio-cubital nerve (*n. radio-medio-cubitalis*); these disunite already before the base of the wing; the other branch is the anal nerve (*n. analis*).

Penetrating into the wing, the collective costo-subcostal nerve (*n. costo-subcostalis*) sends off the small and short costal nerve (*n. costalis*), which runs to the praecostal plate and by means of sensory-nerve cells innervates over twenty sense hairs, which appear there.

The remaining part of the collective nerve runs as the subcostal nerve (*n. subcostalis*) in the veinlet Sc, and more or less at the height of the praecostal plate innervates the subcostal group of pores. In its further course the subcostal nerve splits off short branchlets or fibres which reach out to the sensory-nerve cells. These cells innervate the small sense hairs which appear rather thickly at the base and much more scarcely in the continuation of the veinlet Sc.

The collective radio-medio-cubital nerve (*n. radio-medio-cubitalis*) just after having penetrated into the wing splits off a thick bundle of fibres which innervates by means of sensory-nerve cells the first radial group of pores and a smaller bundle of fibres which innervates in the same way the second radial group of pores. A little further on the collective trunk sends off the cubital nerve (*n. cubitalis*) which runs in the veinlet Cu, and the trunk itself goes on as the radio-medial nerve (*n. radio-medialis*) in the veinlet R+M, where it splits off many small fibres which innervate by means of sensory-nerve cells the sense hairs visible on the veinlet R+M. In the place where this veinlet divides into two veinlets: R_{1+2} and R_3 the nerve correspondingly also splits into two branches, one of which (*n. radialis primus*) runs through the veinlet R_1, where it innervates the chitinous hooks, there situated. In the Saw-fly *Allantus arcuatus* Forst. only the first row of hooks that lies nearer to the anterior margin of the wing is innervated, and in the Saw-fly *Rhogogaster viridis* L. the first radial nerve innervates only the second row of hooks which lies nearer to the veinlet R_2.

The other branch (*n. radialis tertius*) runs in the veinlet R_3, to the distance of more or less $^3/_4$ of its length, and in its course splits off short nerve fibres, which join the sensory-nerve cells that innervate the fine sense hairs on the veinlet R_3. The veinlet R_2 and the veinlet M, which at first goes together with the veinlet R_3 and then separates from it, are not innervated. I did not find in them any nerve elements which would correspond to the second radial nerve or to the medial nerve.

The cubital nerve (*n. cubitalis*) after getting separated from the collective radio-medio-cubital nerve, runs in the veinlet Cu up to the place, where this veinlet is joined by the first transversal veinlet. In its course the cubital nerve sends off short nerve fibres which innervate the scarce sense hairs placed on the veinlet Cu by means of the sensory-nerve cells.

The anal nerve (*n. analis*) shots off from the alar nerve already before the base of the wing, and penetrates into the wing independently of the aforesaid nerves. This nerve runs in the veinlet A_1, till it joins the veinlet A_2, and by means of short nerve fibres and of sensory-nerve cells innervates the fine sense hairs, which are situated on the veinlet A_1.

The veinlets: A_2 and A_3 are not innervated.

Final remarks

In comparison to the wings of the honey-bee (*Apis mellifica* L.) those of the Saw-flies are more poorly provided with sense organs. Surely, there appear on them the same types of sense organs as in the honey bee (sense hairs or *sensillae trichoideae*, chordotonal organs and pores or *sensillae campaniformes*) but the number of the latter is smaller. This is shown on the table enclosed below:

	Honey-bee	Saw-flies
Single pores		
on the anterior wing:		
on the veinlet R+M	—	6
„ „ „ R_1	8—11	20—25
„ „ „ M	3—5	—
„ „ transversal veinlet m-cu	not numerous	—
„ „ veinlet Cu	very scarce	—
„ „ Sector Radii and R_3	10—15	—
„ „ praecostal plate	not numerous	—
on the posterior wing:		
on the veinlet R_s + M	appear rarely	—
in the basal part of the veinlet Cu	and very scarcely	—
Groups of pores		
on the anterior wing:		
the subcostal groups	3	3
„ radial groups	3	1
„ anal groups	1	—
on the posterior wing:		
the subcostal groups	1	1
„ radial groups	1	2
„ basoanal groups	1	—

As regards the size, the pores of the Saw-flies, the diameter of which is about 8 μ, are intermediate between the small pores (diameter: 5 — 6 μ) and the big pores (diameter: 10 — 12 μ) in the honey-bee.

The sense hairs of the Saw-flies resemble very much those which appear on the wings of the honey-bee. Also, the chordotonal organs appearing in those insects in the same number show a strong resemblance (in the anterior wing: the antealar chordotonal organ in the tegula, the radial, medial and cubital organs at the base of the wing; lack of chordotonal organs in the posterior wing).

The chitinous hooks, which also are a sense organ, form a row on the wing of the honey-bee and two rows on the wings of the Saw-flies, though these rows tend to become a single one on both ends. In the Saw-fly *Allantus arcuatus* Forst. only the first row of hooks is innervated, and in *Rhogogaster viridis* L. — only the second row. One can therefore think, that the appearance of two rows of hooks is a more primitive feature than the presence of one only.

In the anterior wings of the Saw-flies are innervated: the tegula, the veinlets C and Sc, the collective vein R+M+Cu, the pterostigma, in which run the nerves corresponding to these of the veinlets R_1 and R_2, the long enough sections of the veinlets: R_3, M, Cu and both anal veinlets. On the other hand the distal parts of the veinlets: R_1, R_2, R_3, M and Cu, and the transversal veinlets which lie between these are not innervated. The transversal veinlet, which connects the veinlet A_1 with A_2, is innervated only in the wings of the Saw-fly *Allantus arcuatus* Forst., and in *Rhogogaster viridis* L. it is always deprived of any nerve elements.

In the posterior wing the nerves run in the veinlet C and Sc, in the collective vein R+M, in the veinlet R_1, in the proximal parts of the veinlets: R_3, Cu and A_1. I have found, however, no nerve elements in the veinlets: R_2, R_{1+2}, M, A_2, A_3; nor in the distal parts of the veinlets: R_3, Cu, A_1.

As one can infer from the aforesaid facts, the proximal parts of the wings of the Saw-flies are more abundantly innervated than the distal parts, and also some sense organs (groups of pores and chordotonal organs) are assembled in the proximal parts of the wings and in the tegula. This corresponds fully to the conditions in the wings of the honey-bee; the Saw-flies show, however, a small number of some sense organs (single pores, groups of pores). This fact is perhaps connected with their pertaining to the subordo *Tenthredinoidea*, more primitive than that of the Stinging *Hymenoptera* (*Aculeata*).

The investigations for the present paper were carried out in the Department of Zoology of the Jagiellonian University in Kraków. I take this opportunity of expressing my best thanks to the Director of the Department of Zoology, Professor Dr. Stanisław S m r e c z y ń s k i.

Streszczenie

Autorka zbadała występowanie narządów zmysłowych i gałęzi nerwowych w skrzydłach dwóch gatunków pilarzy: *Allantus arcuatus* Forst. i *Rhogogaster viridis* L. (*Hymenoptera, Tenthredinoidea*).

W skrzydle przednim wymienionych owadów występują następujące narządy zmysłowe: włoski zmysłowe (mieszczące się na żyłkach i w ich bezpośredniej okolicy), kopułki zmysłowe (występujące w trzech grupach podbrzeżnych, w grupie promieniowej i pojedynczo na żyłkach: R+M i R) oraz narządy chordotonalne (promieniowy, środkowy i łokciowy). W teguli występują włoski zmysłowe i narząd chordotonalny tegularny, czyli przedskrzydłowy.

Autorka opisuje w przednim skrzydle przebieg nerwów: przedskrzydełkowego (tegularnego), brzeżnego, podbrzeżnego, promieniowego (z trzema gałęziami), środkowego, łokciowego i analnego (z dwiema gałęziami), a nadto u *Allantus arcuatus* Forst. unerwienie żyłki poprzecznej łączącej żyłki: A_1 i A_2.

W skrzydle tylnym występują jako narządy zmysłowe: włoski, kopułki i haczyki. Kopułki tworzą tu jedną grupę podbrzeżną i dwie grupy promieniowe, nie występują natomiast pojedynczo. Haczyki leżą w dwu szeregach na żyłce R_1; u pilarza *Allantus arcuatus* Forst. tylko pierwszy, a u *Rhogogaster viridis* L. — tylko drugi szereg haczyków jest unerwiony.

W tylnym skrzydle występują następujące nerwy: brzeżny, podbrzeżny, promieniowy pierwszy, promieniowy trzeci, łokciowy i analny pierwszy. Brak natomiast gałęzi, które odpowiadałyby nerwom: promieniowemu drugiemu, środkowemu, analnemu drugiemu i analnemu trzeciemu u innych owadów.

Autorka stwierdziła dość bogate (chociaż uboższe niż np. u pszczoły) występowanie elementów nerwowych i zmysłowych oraz skupienie tych elementów w proksymalnych częściach skrzydeł pilarzy.

Резюме

Автор исследовал органы ощущения и нервы у двух видов настоящих пилильщиков: *Allantus arcuatus* Forst. и *Rhogogaster viridis* L. (*Hymenoptera, Tenthredinoidea*).

В переднем крыле выше упомянутых насекомых присутствуют следующие органы ощущения: *sensillae trichoideae* (на жилках и поблизости последних), *sensillae campaniformes* выступающие в трех субкостальных группах, в радиальной группе и поодиночке на жилках: R+M и R и хордотональные органы (радиальный, медиальный и кубитальный). В тегуле находятся *sensillae trichoideae* и *organum chordotonale tegulare* или *antealare*.

Автор описывает в переднем крыле ход следующих нервов: *n. antealaris* (*tegularis*), *n. costalis*, *n. subcostalis*, *n. radialis* (с тремя разветвлениями), *n. medialis*, *n. cubitalis*, *n. analis* (с двумя разветвлениями) и (у *Allantus arcuatus* Forst.), нервы поперечной жилки, соединяющей жилки A_1 и A_2.

В заднем крыле выступают следующие органы ощущения: *sensillae trichoideae*, *sensillae campaniformes* и крючки. *Sensillae campaniformes* образуют здесь одну субкостальную и две радиальных группы, не выступая поодиночке. *Hamuli* (крючки) расположены в два ряда на жилке R; у *Allantus arcuatus* Forst. только первый и у *Rhogogaster viridis* L. только второй ряд обладает нервами.

В заднем крыле присутствуют следующие нервы: *n. costalis*, *n. subcostalis*, *n. radialis primus*, *n. radialis tertius*, *n. cubitalis*, и *n. analis primus*. В то место отсутствуют разветвления, у других насекомых отвечающие *n. radialis secundus*, *n. medialis*, *n. analis secundus*, *n. analis tertius*.

Автор констатировал относительно значительное (хотя менее чем у *Apis*) выступленые нервных элементов и органов ощущений у пилильщиков со сосредеточением последних в проксимальных участках крыл.

Piśmiennictwo

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