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Some cases of morphological deformations in weevils (*Curculionoidea*, *Coleoptera*)

Kilka przypadków zniekształceń morfologicznych u ryjkowców (*Curculionoidea*, *Coleoptera*)

SUMMARY

The article contains the description of eleven specimens of weevils (*Coleoptera*, *Curculionoidea*), with morphological deformations of the rostrum, palps, head, oculus, prothorax, elytron and limbs. The weevils under discussion were isolated from 26,477 specimens, belonging to 436 species. The insects were collected in some protected areas in Eastern Poland and in urban green in Lublin. Certain correlations between the frequency of deformation occurrence and human activities can be discerned.

STRESZCZENIE

Praca przedstawia opisy 11 przypadków morfologicznych zniekształceń zaobserwowanych u ryjkowców (*Coleoptera*; *Curculionoidea*). Opisywane zniekształcenia dotyczyły budowy: odnóży, czułków, ryjka, głowy, przedplecza i pokryw. Zmiany morfologiczne u dorosłych chrząszczy ryjkowcowatych obserwowane są niezwykle rzadko. Stąd mechanizm powstawania nieprawidłowości w budowie ciała i wpływ potencjalnych czynników etiologicznych nie jest wyjaśniony. Można jednak dopatrywać się pewnych korelacji pomiędzy częstością występowania zaburzeń w budowie chrząszczy a działalnością człowieka.

Keywords: weevils, *Curculionoidea*, teratology, morphological deformations, environmental protection.

INTRODUCTION

The teratological changes in weevils are found in less than 1 out of 1100 specimens (5), while among other orders of insects such as dragonflies they are also respectively rarely detected (3). The interpretation of these abnormalities is difficult due to the scarcity of experimental material. Furthermore, it is impossible to observe the whole development cycle of teratological subjects (5). Nevertheless, methodical studies make it possible to reveal the etiological basis of this process (2). Causes of structural changes are connected with such factors as damage in the early stages of development, the effect of pathogens, the influence of unfavourable environmental conditions and spontaneous or induced mutations. Mechanical injuries, manifested by an asymmetry in structure, can be a consequence of a predator's attack right after metamorphosis (3) or physical pressure exerted on the pupa by its surroundings (5). The influence of pathogenic bacteria, fungi or viruses is manifested by changes in the size, coloration, integument sculpture, distribution and in the structure of chaetae (9). Polymelic, caused by genetic mutations, is one of the most interesting types of abnormalities. It assumes the form of symmetrical appendices on the prothorax (10), third eye, accessory tarsus (6; 7) or the supernumerary limb (8). Such abnormalities in the structure of palps as atypical morphology of segments or the whole antennas or complete absence of palps are described most often (5). Some chemical substances as pesticides and fertilisers, despite their direct cancerogenic effect, change the microenvironment of the soil. These changed conditions facilitate the growth of fungi producing mutagenic and cancerogenic toxins. Complicated chemico-physical factors as well as changes in climatic conditions can lead to morphological deformations, especially if they occur during the vulnerable period of insect metamorphosis (1; 9). The structural abnormalities could develop during the process of embryogenesis, but insects with even advanced morphological deformations can stay alive for a few days (4).

MATERIAL AND METHODS

The faunistic research was conducted between years 1999–2005 in some protected areas in Eastern Poland (The Krzczonowski Landscape Park, Stawska Góra Reserve, and the river Bug valley, in Lublin city and Bieszczady Mountain. The investigated stations present different structures of plant communities: semi-natural (xerothermic grass communities) or anthropogenic ones (extensively used meadows, pasture, wastes communities and urban green). The weevils were collected with an entomological scoop from herbaceous plants. In this study 26,477 specimens were used, belonging to 436 species of the weevils collected. Out of this number, 11 specimens (10 species) exhibited an abnormal morphological structure. The deformations were detected in the structure of rostrum, palps, oculus, prothorax, elytron and in the shape of limbs.

DESCRIPTION OF DEFORMATION

1. *Catapion seniculus* (Kirby, 1808) (Fig. 1b); 15.06.2000; Krzczonowski LP, Częstoborowice; xerothermic waste communities used as pasture. Transversal sulcus with parallel margin – localised dorsally, in approximately 1/3 of rostrum's length from its base (Fig. 1a). A marked tubercle can be detected directly behind the sulcus in the direction (towards) of rostrum base. Apex of rostrum and antennae localisation unchanged.

2. *Catapion seniculus* (Kirby, 1808) (Fig. 2b); 17.07.2002; the river Bug valley, Stare Stulno; extensively used meadow (*Molinio-Arrhenatheretea*). Anomalies of rostrum, antennae and eye are detected in this specimen (Fig. 2a). Rostrum twisted and its transversal section irregular in-

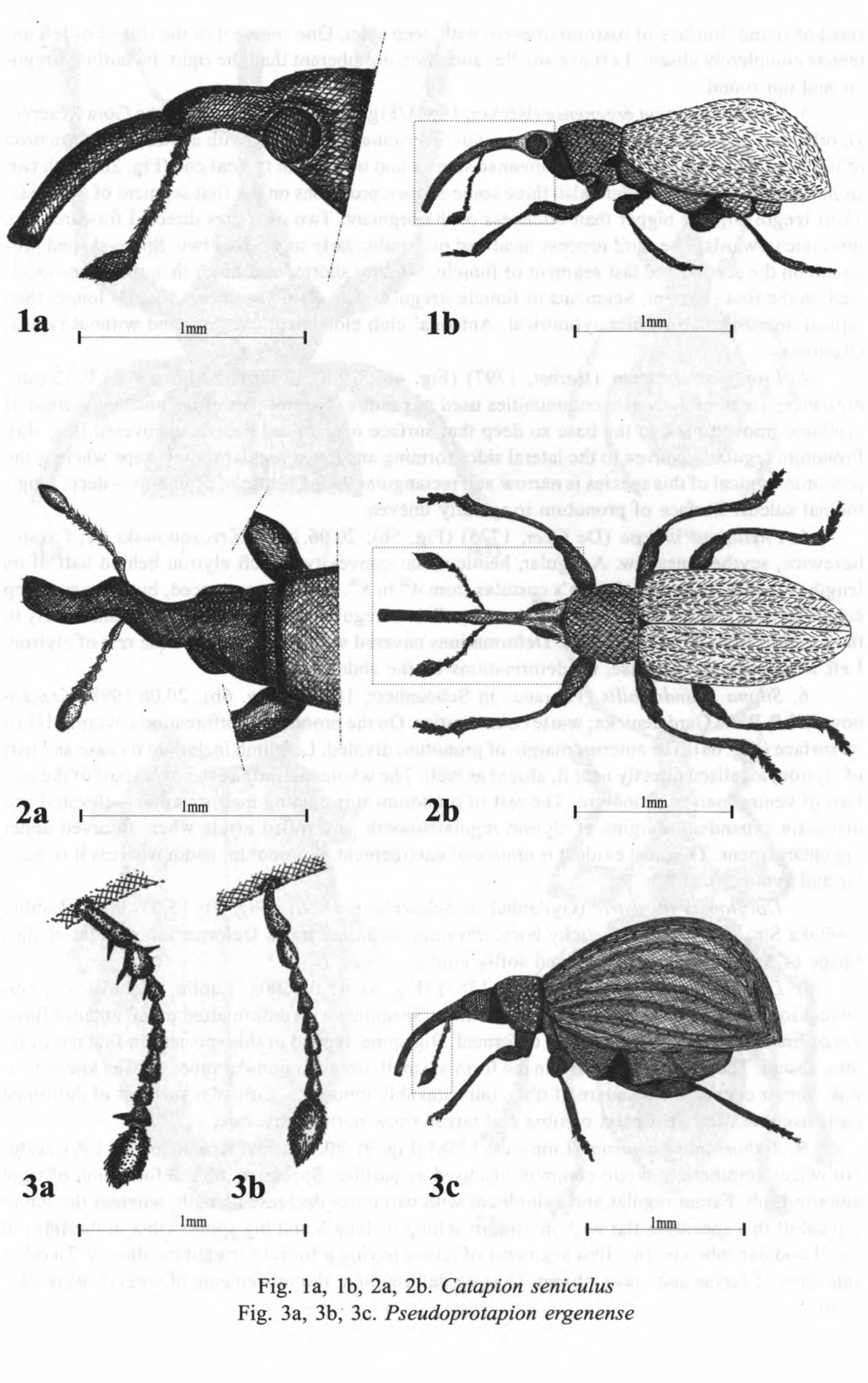


Fig. 1a, 1b, 2a, 2b. *Catapion seniculus*
Fig. 3a, 3b, 3c. *Pseudoprotapion ergenense*

stead of round. Surface of rostrum uneven, with deep sulci. One segment in the finical of left antennae completely absent. Left eye smaller and more protuberant than the right. Its outline irregular and not round.

3. *Pseudoprotapion ergenense* (Becker, 1864) (Fig. 3c); 04.06.1998; Stawska Góra Reserve; xerothermic grass communities (*Brachypodio-Teucrietum*). Specimen with advanced deformation of left antennae (Fig. 3a). Scape of antennae shorter and wider than typical one (Fig. 3b), with two spine-like processes. There are also three spine-shaped processes on the first segment of antennae. Their length slightly bigger than thickness of the segment. Two of spines directed forwards, the third one upwards. The third process localized perpendicularly to the first two. Spine-shaped processes on the second and last segment of funicle. Slightly shorter and wider than processes localized on the first segment. Segments of funicle irregular. The 4^{th}–6^{th} segments slightly longer than typical one. Not narrow and cylindrical. Antennal club elongated, irregular and without typical chaetotaxy.

4. *Protapion apricans* (Herbst, 1797) (Fig. 4b); 19.07.1998; Krzczonowski LP, Częstoborowice; xerothermic waste communities used as pasture. Central part of the anterior margin of prothorax moved back to the base so deep that surface of the head base is uncovered (Fig. 4a). Pronotum regularly convex to the lateral sides forming an almost regular round shape whereas the pronotum typical of this species is narrow and rectangular. In the centre of pronotum – deep, longitudinal sulcus. Surface of pronotum irregularly uneven.

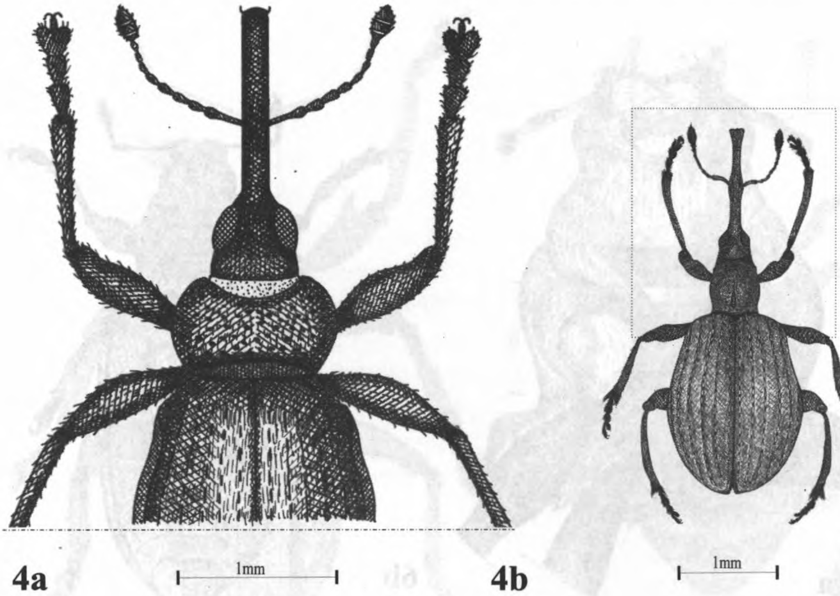
5. *Phyllobius urticae* (De Geer, 1775) (Fig. 5b); 20.06.1998; Krzczonowski LP, Częstoborowice, scythed meadow. A regular, hemicircular convexity on left elytron behind half of its length (Fig. 5a), covering elytron's costulas from 4^{th} to 8^{th}. Also a pronounced, but not very deep sulcus directly behind the described convexity. Sulcus regular, linear and localised transversely to the plastron from 4^{th} to 8^{th} costula. Deformations covered with scales just like the rest of elytron. Left wing normal. Likewise, no deformations on the abdomen.

6. *Sitona cylindricollis* (Fahraeus in Schoenherr, 1840b) (Fig. 6b); 20.06.1998; Krzczonowski LP, Wola Gardzienicka; waste communities. On the pronotum a bifurcation covering 1/3 of its surface (Fig. 6a). The anterior margin of pronotum divided. Left limb including its base and part of elytron, localised directly near it, absent as well. The whole malformation covers half of the surface of ventral part of pronotum. The rest of pronotum surrounding malformation – elevated and distinctly expanded. Margins of elytron regular/smooth, and rolled inside when observed under big enlargement. The most evident is unnatural enlargement of pronotum width whereas it is regular and symmetrical.

7. *Dorytomus filirostris* (Gyllenhal in Schoenherr, 1836). (Fig. 7); 15.05. 2005; Lublin, Głęboka Str.; collected from sticky horse-chestnut leafminer traps. Deformation of right oculus. Shape of oculus narrow, oblong and softly convex.

8. *Dorytomus tremulae* (Fabricius, 1787) (Fig. 8); 15.05.2005; Lublin, Głęboka Str.; collected from sticky horse-chestnut leafminer traps. Specimen with deformation of left anterior limb. 1/4 of final part of femur irregularly deformed. Big spine, typical of this species, on first par of femur, absent. The larger part of tibia in the form of small, irregular nodular tubercle. The knee invisible. Femur connected to square of tibia, unmistakably immobile. Cuticular surfaces of deformed parts aspirate. Terminal parts of tibia and tarsus show normal structure.

9. *Anthonomus pomorum* (Linnaeus, 1758) (Fig. 9). 20.06.1998; Krzczonowski LP, Częstoborowice; xerothermic waste communities used as pasture. Specimen with deformation of right anterior limb. Femur regular and cylindrical with two times decreased length, whereas the femur typical of this species is flat with incision reaching its length and big spine. Tibia in the form of small nodular tubercle, two first segments of tarsus having a form of irregular callosity. Two last segments of tarsus and claws absent. Despite deformation, the movements of weevils were efficient.



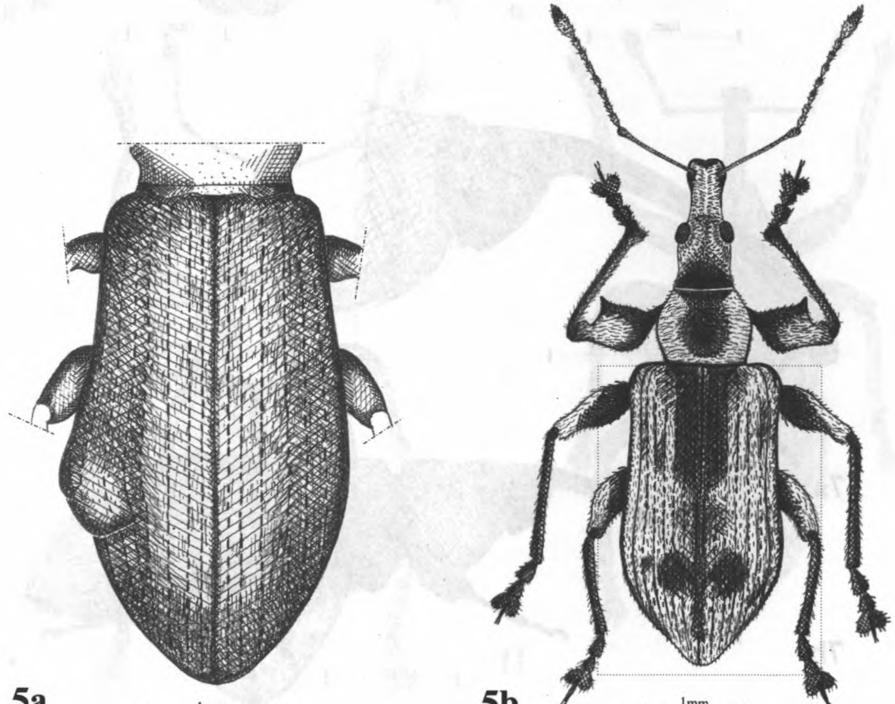
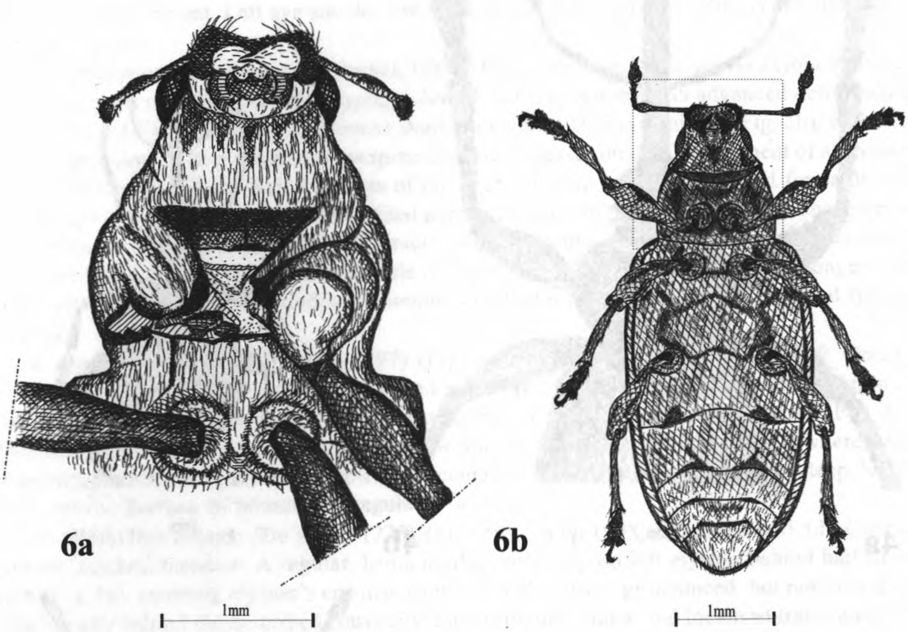


Fig. 4a, 4b. *Protapion apricans*
Fig. 5a, 5b. *Phyllobius urticae*



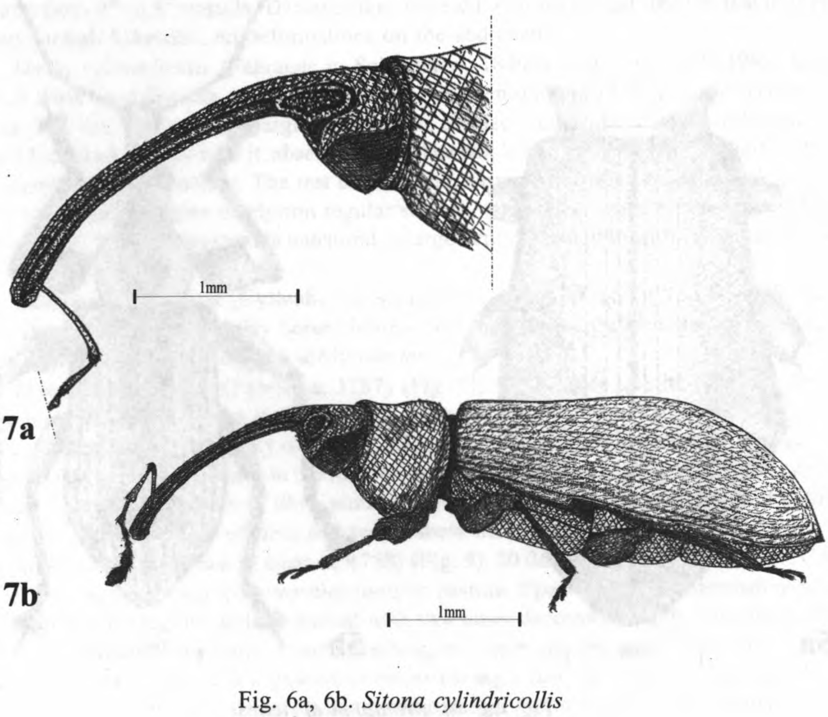
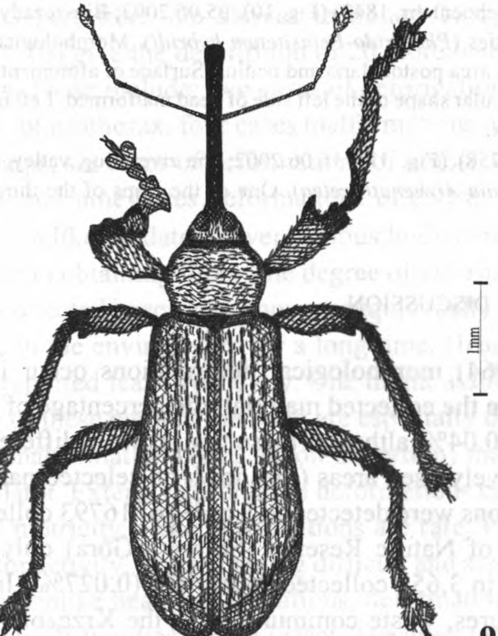


Fig. 6a, 6b. *Sitona cylindricollis*
Fig. 7a, 7b. *Dorytomus filirostris*



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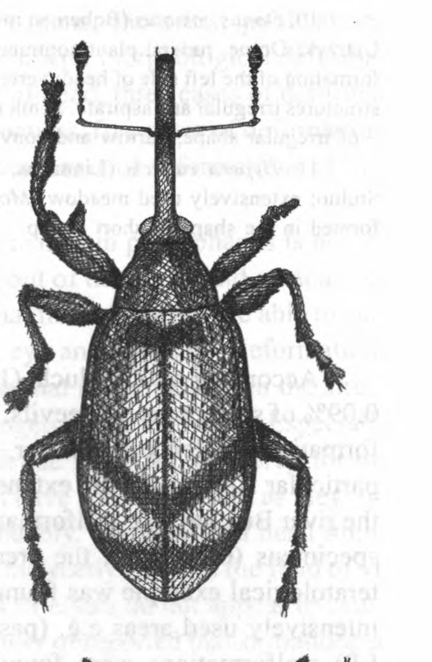

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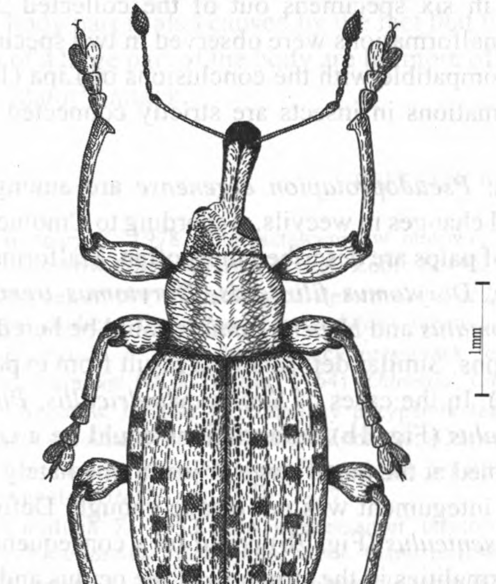

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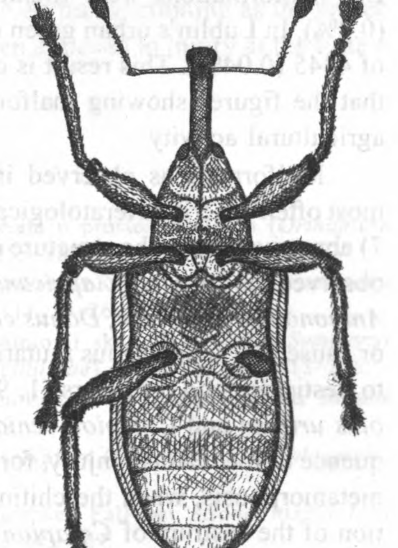

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Fig. 8. *Dorytomus tremulae*; Fig. 9. *Anthonomus pomorum*; Fig. 10. *Donus comatus*; Fig. 11. *Hypera rumicis*

10. *Donus comatus* (Boheman in Schoenherr, 1842) (Fig. 10). 05.06.2002; Bieszczady, near Ustrzyki Dolne, ruderal plant communities (*Phalarido-Petasitetum hybridi*). Morphological deformation of the left side of head: vertex, area postocularis and oculus. Surface of aforementioned structures irregular and aspirate. Semicircular shape of the left side of head malformed. Left oculus – of irregular shape, narrow and convex.

11. *Hypera rumicis* (Linnaeus, 1758) (Fig. 11). 16.06.2002; the river Bug valley, Stare Stulno; extensively used meadow (*Molinio-Arrhenatheretea*). One of the leaps of the third pair formed in the shape of short stump.

DISCUSSION

According to Cmoluch (1964) morphological deformations occur in ca 0.09% of specimens of weevils. In the collected material, the percentage of malformation incidence was lower – 0.04%, although these figures were different in particular stations. In the extensively used areas (meadows on selected parts of the river Bug valley), malformations were detected in 2 cases of 16793 collected specimens (0.02%). In the area of Nature Reserve (Stawska Góra) only one teratological example was found in 3,652 collected specimens (0.027%). In the intensively used areas e.g. (pastures, waste communities in the Krzczonowski LP) malformations were found in six specimens out of the collected 2,857 (0.2%). In Lublin's urban green malformations were observed in two specimens of 4345 (0.04%). This result is compatible with the conclusions of Lipa (1967) that the figures showing malformations in insects are strictly connected with agricultural activity.

Malformations observed in: *Pseudoprotapion ergenense* are among the most often described teratological changes in weevils. According to Cmoluch (5; 7) abnormalities in the structure of palps are described most often. Malformation observed in *Protapion apricans, Dorytomus filirostris*, *Dorytomus tremulae*, *Anthonomus pomorum*, *Donus comatus* and *Hypera rumicis* could be hereditary or caused by spontaneous mutations. Similar deformations result from exposure to pesticides and fertilisers (1; 9). In the cases of *Sitona cylindricollis, Phyllobius urticae* and *Catapion seniculus* (Fig. 1b) deformations could be a consequence of mechanical injury, formed at the pupal stage or just immediately after metamorphosis, when the chitin integument was not elastic enough. Deformation of the rostrum of *Catapion seniculus* (Fig. 2b) could be a consequence of mechanical injury, whereas abnormalities in the structure of the oculus and palp presumably indicate genetic mutation. It appears that human activities (especially in agriculture) are related to the high number of malformations detected in weevils. It is possible that: pesticides, fertilisers, agromechanical procedures or livestock activities could be a cause of the high number of morphological deformations.

Apart from the above-mentioned 11 specimens, the citied publications (5–7; 10) give the description of 20 more weevils with morphological deformations. These include: two cases of deformations of head, three cases of deformations of prothorax, four cases malformations of oculus, five cases of deformation of palps, six cases of deformations of limbs, seven cases of deformations of rostrum and nine cases deformations of elytra.

Unlike predators, even serious body abnormality in phytophages is no obstacle in obtaining food. The degree of wearing out of the scales and carapace of the collected specimens shows unequivocally that these insects were able to survive in the environment for a long time. Head, eye and pronotum deformations are reported least frequently. One might assume that abnormalities in the structure of these parts of the body are especially dangerous for the insect. Especially eye malformations (and vision distortion) make the insect an easy prey for the predator. Extensive pronotum deformations can have a similar effect as they impair motricity. Head deformations are rare. Probably, the deformed head limits motor activity, makes feeding difficult and also indirectly changes the field of vision. Unlike head malformations, deformations of elytra do not appear to cause serious difficulties for the insect. The great number of reported malformations of this body part is also caused by the fact that the elytra functioning as the protection of a large part of the body are far more often exposed to injury at the time of a predator's attack.

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