

Papéis Avulsos de Zoologia

NEW SPECIES OF *NEOELMIS* FROM SOUTH AMERICA (COLEOPTERA, ELMIDAE)

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INTRODUCTION

The genus *Neoelmis* Musgrave will almost certainly prove to be the largest genus of Elmidae in the Western Hemisphere, and no less than 47 species have been described including those in press elsewhere (Hinton, 1972) and the 12 new species described here. An account of the external and internal anatomy of the genus has been given previously (Hinton, 1940a, 1940b) and need not to be repeated here.

This paper is based upon collections given to me for identification by the Chicago Museum of Natural History, Dr. R. E. Woodruff, Professor Harley P. Brown, and upon a large collection recently purchased by me from Mr. F. Plaumann. In addition, one new species collected by me in the Amazon Basin in 1937, and omitted from my revision of the Brazilian species (Hinton, 1940b), is described.

The material available of the 12 new species is as follows:

<i>Neoelmis reichardti</i> , sp. n.	18
" <i>maro</i> , sp. n.	28
" <i>thyas</i> , sp. n.	1
" <i>sul</i> , sp. n.	18
" <i>alcine</i> , sp. n.	1
" <i>atys</i> , sp. n.	1
" <i>mormo</i> , sp. n.	48
" <i>nicon</i> , sp. n.	391
" <i>nelo</i> , sp. n.	5
" <i>mila</i> , sp. n.	9
" <i>anytis</i> , sp. n.	9
" <i>opis</i> , sp. n.	9
Total	538

The colour of the cuticle has been omitted from the descriptions except in the *maculata* species-group, in which colour is often useful in distinguishing the species. Punctures referred to as microscopic punctures are those that are distinctly finer than the

facets of the eyes. The primitive pattern of the surface of the cuticle consists of polygons, usually hexagons, the shapes of which correspond to the shapes of the epidermal cells at the time that the cuticle was secreted (Hinton, 1970). The margins of the polygons are often ridge-like so that the surface has a reticulate appearance, and the term "reticulate microsculpture" is here used for such surfaces. One of the important distinguishing features of the species is the area of the hypomera that is smooth. Areas described as smooth are those that appear to be smooth at a magnification of about 100. However, when such areas are viewed at much higher magnifications with the scanning electron microscope they are often also reticulate but the ridges are so low that they cannot be resolved with the dissecting microscope.

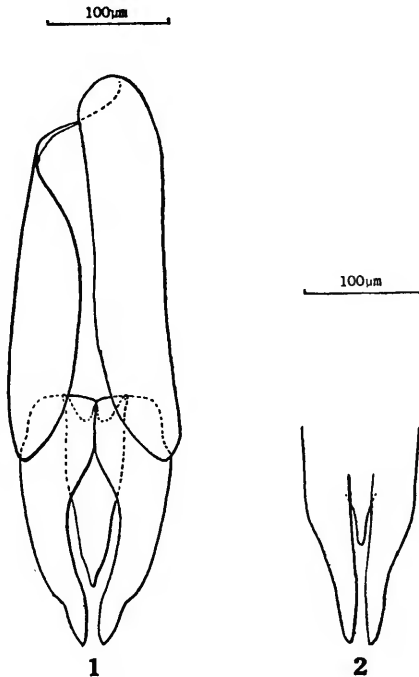
The holotype of *N. reichardti* has been deposited in the Museu de Zoologia, Universidade de São Paulo, the holotype of *N. sul* in the British Museum (Nat. Hist.), the holotype of *N. maro*, *N. alcine*, *N. mormo*, and *N. mila* in the Chicago Natural History Museum, and the holotypes of *N. anytis* and *N. opis* in the U.S. National Museum. The holotypes of *N. thyas*, *N. atys*, *N. nicon* and *N. nelo* remain for the time being in my collection. Where there was enough material, paratypes of the species have been deposited in the British Museum (Nat. Hist.), the Chicago Museum of Natural History, the U.S. National Museum, the Museu de Zoologia, Universidade de São Paulo, and the collection of Professor Harley P. Brown.

***Neelmis reichardti*, sp. n.**

(Plate I, figs. 1-4; Figs. 1-2)

Male. Length, 1.7 mm.; breadth 0.60 mm. Body subparallel. *Pronotum* across broadest point, which is at about basal third, slightly narrower than long (0.52 mm.: 0.50 mm.) and base broader than apex (0.47 mm.: 0.34 mm.). Side moderately arcuate on basal half, less arcuate on apical half, and broadly and moderately shallowly arcuately emarginate before basal angle. Lateral margin when seen from side broad and distinctly double on basal two-thirds, narrower anteriorly, and much narrower and single on anterior fifth. Disk behind transverse depression slightly but distinctly longer than disk before depression (0.29 mm.: 0.24 mm.); anterior and posterior convex parts of disk with microscopic punctures sparse, often separated by five or more diameters; transverse depression with a wide (0.05 mm. at middle) area that is microscopically reticulate; disk at base between sublateral carinae with a somewhat flattened strip about two-thirds as long as scutellum; puncture on each side of middle of base deep and large so that from some angles the pronotum appears to have a very short, broad, median carina at base. *Hypomera* with middle area before and behind depression sparsely punctate but elsewhere microscopically reticulate. *Elytra* slightly more than twice as long as pronotum (1.10 mm.: 0.52 mm.) and base slightly broader than pronotum at broadest point; very feebly widened behind base to broadest point at about apical two-fifths. Humeri feebly gibbous. Strial punctures of basal discal region deep, round to subquadrate,

about as broad as intervals, and separated longitudinally by about their diameters; with a single distinct accessory stria near base. Discal intervals flat; surface of basal discal intervals moderately sparsely, microscopically punctate. Scutellum obovate, flat, and surface sparsely punctate. *Prosternum* when seen from side with anterior three-fifths (not including process) moderately bent ventrally. Plastron present on basal half to three-fifths from lateral margin to carina. Sides of process distinctly thickened. Carinae distinct, converging anteriorly. Lateral ridge absent or very indistinct. *Metasternum* with posterior four-fifths of disk broadly concave; median longitudinal depression broad and deep on posterior two-thirds; surface of disk on each side of median depression strongly shining and with a few punctures about two-thirds as coarse as facets of eyes; posterior margin on each side opposite mesal margin of coxa with a group of short, stout, suberect setae (Plate I, fig. 1). *Abdomen* with discal carinae of first sternite distinct and disk deeply concave. Second sternite with disk feebly depressed; on each side of disk near anterior margin with a group of setae (Plate I, fig. 2) very similar to tuft of setae on each side of posterior margin of metasternum; apex of fifth sternite with a broad, oval, shallow, indistinct depression. Plastron absent on



Neoelmis reichardti, sp. n.: 1, dorsal view of male genitalia; 2, apices of parameres drawn with the genitalia turned so that the downward curved apices are on a horizontal plane.

disk of first four sternites and near anterior margin of disk of fifth sternite. *Legs* with plastron absent on trochanters, complete on femora, and absent on dorsal side of tibiae.

Female. Externally similar to male except as follows: (1) reticulate area of pronotal disk more clearly defined and at middle of disk twice as long as in male (0.10 mm.: 0.05 mm.); (2) metasternum on each side of posterior margin with a tuft of suberect setae; (3) second abdominal sternite without a brush of suberect setae on each side near anterior margin of disk; (4) extreme posterior margin of second abdominal sternite with plastron complete instead of absent; (5) third abdominal sternite with plastron absent only on anterior third of disk instead of all of disk; and (6) fourth abdominal sternite with plastron absent only on a narrow anterior strip of disk.

Holotype. ♂, Brazil: Santa Catarina, Nova Teutônia, 1970, 1971 (*F. Plaumann*) in the collection of the Museum of Zoology, University of São Paulo.

Paratypes. 7 ♂♂ and 10 ♀♀ with same data as holotype.

Comparative notes. This species keys out at couplet "10" in my revision of the Brazilian *Neoelmis* (Hinton, 1940b). The broad belt of reticulate microsculpture on the transverse depression of the pronotum will serve to distinguish it from *H. nana* Hinton (1940) and all other known South American species of the genus.

The difference between the two sexes in the extent of the reticulate microsculpture of the pronotum is most unexpected, and for a time the female was thought to belong to another species.

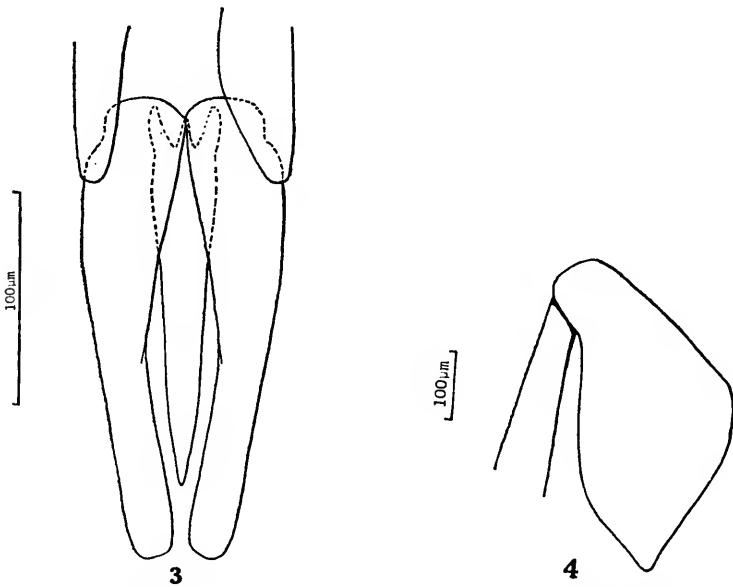
I take pleasure in naming this species after Dr. Hans Reichardt.

Neoelmis maro, sp. n.

(Fig. 3)

Male. Length, 1.5 mm.; breadth, 0.56 mm. Body subparallel. *Pronotum* across broadest point, which is at about basal third, broader than long (0.45 mm.: 0.43 mm.) and base broader than apex (0.38 mm.: 0.32 mm.). Side shallowly and broadly, arcuately emarginate opposite transverse depression and scarcely noticeably emarginate before basal angle. Lateral margin when seen from side double to, or very nearly to, apex; behind transverse depression width everywhere equal. Disk behind transverse depression much less than twice as long as disk before depression (0.26 mm.: 0.18 mm.). Sublateral carinae prominent but ending about length of terminal antennal segment from apical margin. Anterior and posterior convex parts of disk with punctures about half as coarse as facets of eyes and usually separated by five or more diameters; puncture on each side of middle base about half as wide as scutellum and deep so that area between appears carina-like from some angles. *Hypomera* with all of middle area both before and behind anterior depression smooth, but extreme apex and base with a reticulate microsculpture. *Elytra* more than twice as long as pronotum (1.05 mm.: 0.43 mm.) and base across humeri only slightly wider than widest part of pronotum. Humeri feebly gibbous. Strial punctures of basal discal region much narrower

than intervals and separated longitudinally by several times their diameters; between first stria and sublateral carina there is a broad, feebly gibbous area on which strial punctures are much finer than those of sutural stria. Discal intervals flat and surface sparsely, microscopically punctate. Scutellum broadly oval, flat. *Prosternum* when seen from side with anterior three-fifths (not including process) moderately feebly bent ventrally. Plastron present on posterior three-fifths and extending up to carinae. Side of process somewhat thickened. Carinae converging anteriorly. Lateral ridge absent. *Metasternum* with median longitudinal line distinct on posterior four-fifths; posterior half with a deep and moderately broad depression. Surface of disk with a few widely separated punctures about as coarse as facets of eyes. With two setae (Pl. II, fig. 3) on posterior margin opposite mesal side of coxa. *Abdomen* with discal carinae of first sternite distinct; disk of first sternite only shallowly depressed; second sternite with a group of three, stout setae (Pl. II, fig. 4) on anterior third on each side of middle. Plastron present only on sides of sternites but first and second sternites each with a narrow and nearly complete posterior belt. *Legs* with plastron absent on trochanters and all but ventral side of tibiae; complete on femora.



Neoelmis maro, sp. n.: 3, dorsal view of male genitalia.
N. alcine, sp. n.: 4, front femur of male.

Female. Externally similar to male but (1) without the tuft of two setae on each side of posterior margin of metasternal disk, and (2) without the tuft of three setae on each side of disk of second abdominal sternite.

Holotype. ♂, Brazil: Paraná, Rio do Campo, Guarapuava, 1,000 m., iii. 1963 (F. Plaumann).

Paratypes. 10 ♂♂, 17 ♀♀, with the same data as holotype.

Comparative notes. No other known species of *Neoelmis* has the plastron more or less restricted to the sides of the abdominal sternites. The new species appears to be most closely related to *N. reichardti* but from that species may be distinguished by having only a very narrow instead of an unusually broad reticulate belt in the transverse pronotal depression.

Neoelmis thyas, sp. n.

Female. Length, 1.3 mm.; breadth, 0.5 mm. Body subparallel. *Pronotum* across broadest point, which is at about middle, narrower than long (0.42 mm.: 0.45 mm.) and base broader than apex (0.39 mm.: 0.23 mm.). Side feebly arcuate and very shallowly, acutely emarginate before basal angle. Lateral margin when seen from side distinctly double on posterior two-thirds. Transverse depression very shallow and on sides of disk scarcely as deep as a broadly oval, median depression. Disk behind transverse depression very little longer than before depression (0.23 mm.: 0.21 mm.); surface of posterior two-thirds of disk densely, microscopically punctate and also with larger punctures about two-thirds as coarse as facets of eyes and usually separated by three to four or more times their diameters; anterior third of disk with punctures much sparser. Sublateral carinae extending to about apical seventh. *Hypomera* everywhere with a reticulate microsculpture. *Elytra* less than twice as long as pronotum (0.76 mm.: 0.45 mm.), base slightly broader than broadest part of pronotum, and feebly widened behind base to broadest point which is at about apical two-fifths. Humeri feebly gibbous. Strial punctures of basal discal region oval to round, nearly as broad as intervals, and separated longitudinally by a little more than their diameters; at base with three accessory strial punctures between second and third striae. Discal intervals flat; surface of intervals moderately densely, microscopically punctate. Scutellum broadly oval, flat, and surface punctate like adjoining intervals. *Prosternum* when seen from side with anterior three-fifths (not including process) feebly bent ventrally; process exceptionally narrow between coxae. Plastron absent. Carinae low, converging anteriorly. Lateral ridge absent. Surface with sparse, fine granules and reticulate to densely, microscopically punctate. *Metasternum* with disk flat; median longitudinal depression about as wide as basal segment of middle tarsus; surface granulate and sculptured like pronotum. *Abdomen* with discal carinae of first sternite short; disk nearly flat; plastron absent on disk of first sternite and apparently (specimen very rubbed) on disks of second and possibly third sternites. *Legs* with plastron complete on femora, and, apart from cleaning fringes, apparently absent on tibiae.

Male. Unknown.

Holotype. ♀, Brazil: Rondônia, Porto Velho, 1.ix.1937 (H. E. Hinton).

Comparative notes. This may be distinguished immediately from all other described species by its very shallow transverse pronotal depression which is scarcely impressed on middle of sides between sublateral carinae and the median, oval depression.

***Neoelmis sul*, sp. n.**

Male. Length, 1.6 mm.; breadth, 0.62 mm. Body subparallel. *Pronotum* across broadest point, which is at about basal third, as broad as long (0.45 mm.) and base broader than apex (0.42 mm.: 0.34 mm.). Side scarcely emarginate opposite transverse depression; narrowly, shallowly, and arcuately emarginate before basal angle. Lateral margin when seen from side double except at extreme apex; margins more or less parallel on basal three-fifths but distinctly converging apically and contiguous before apex. Sublateral carinae prominent and extending very nearly to apical margin. Disk behind transverse depression longer than disk before depression (0.25 mm.: 0.18 mm.); anterior and posterior convex parts with punctures about two-thirds as coarse as facets of eyes and separated usually by two to five diameters; bottom of transverse depression with a narrow belt of more or less contiguous punctures; puncture on each side of middle of base about two-thirds as wide as scutellum and deep so that area between appears to be a flat-topped carina. *Hypomera* with middle area smooth; surface before anterior depression and that of posterior fourth microscopically reticulate. *Elytra* slightly more than twice as long as pronotum (1.05 mm.: 0.45 mm.) and base distinctly wider than pronotum; feebly widened to about apical two-fifths. Humeri moderately gibbous. Strial punctures of basal discal region deep, oval or round, about as broad as intervals, and separated longitudinally by their diameters or slightly less; with one or two accessory punctures near base between second and third striae. Intervals flat and surface sparsely, microscopically punctate. Scutellum flat, broadly oval. *Prosternum* when seen from side with anterior three-fifths (not including process) moderately feebly bent ventrally. Plastron absent except on a very narrow belt along lateral margin. Sides of process thickened. Carinae prominent, parallel. Lateral ridge prominent. *Metasternum* with posterior three-fourths of disk very broadly and deeply concave; disk on each side with numerous coarse, yellowish, subrecumbent setae; posterior margin on each side with a small tuft of erect setae. *Abdomen* with discal carinae of first sternite distinct and disk deeply depressed. Plastron absent only on disks of first and second sternites, except for a narrow posterior belt on each. *Legs* with plastron absent on trochanters, complete on femora, and absent on dorsal side of tibiae.

Female. Externally similar to male except as follows: (1) metasternal disk not quite as widely or as deeply depressed; (2) side of metasternal disk with a plastron and without coarse, subrecumbent setae; (3) posterior margin of metasternum without a tuft of erect setae on each side; and (4) disk of first abdominal sternite less strongly depressed.

Holotype. ♂, Brazil: Goiás, Retiro, vi.1969 (*H. P. Brown*).

Paratypes. 3 ♂♂, 4 ♀♀ with same data as holotype; 1 ♂, 4 ♀♀, Retiro, viii.1966 (*J. M. Davis*); and 1 ♂, 4 ♀♀, Brazil: Maranhão, Rio Sucupira, south of Porto Franco, vi.1964 (*H. P. Brown*).

Comparative notes. The secondary sexual characters and the structure of the male genitalia place this near *N. musgravei* Hinton (1940), but from the latter and related species it may be distinguished by having a well-developed tibial plastron.

Neoelmis alcine, sp. n.

(Fig. 4)

Male. Length, 2.2 mm.; breadth, 0.92 mm. Body subparallel. *Pronotum* across broadest point, which is at about basal third, not as broad as long (0.64 mm.: 0.70 mm.) and base broader than apex (0.60 mm.: 0.41 mm.). Side broadly and arcuately emarginate opposite transverse depression and less broadly so before basal angle. Lateral margin when seen from side double to about apical sixth or seventh and where double more or less evenly wide. Sublateral carinae very prominent and extending to apical margin. Disk behind transverse depression distinctly longer than disk before depression (0.40 mm.: 0.30 mm.); anterior and posterior convex parts with punctures about two-thirds as coarse as facets of eyes and usually separated by three to five diameters; bottom of transverse depression with punctures much denser; puncture on each side of middle of base about half as wide as scutellum. *Hypomera* with a large polished area both before and behind anterior depression; posterior fourth with a reticulate microsculpture. *Elytra* slightly more than twice as long as pronotum and base slightly broader than pronotum; slightly widened to broadest point at about apical third. Humeri feebly gibbous. Strial punctures of basal discal region deep, round, broader than intervals and separated longitudinally by about their diameters or a little less; near base with two accessory punctures between second and third striae. Discal intervals flat; surface sparsely, microscopically punctate. Scutellum obovate, nearly flat. *Prosternum* when seen from side with anterior three-fifths (not including process) moderately strongly bent ventrally. Plastron distinct on basal three-fifths up to prosternal carinae. Sides of process distinctly thickened. Carinae distinct, very prominent, and more or less contiguous. Lateral ridge feebly developed, indistinct. *Metasternum* with posterior four-fifths of disk broadly and deeply depressed; surface of disk polished, sparsely punctate. Abdomen with discal carinae of first sternite distinct and disk deeply concave. Second sternite with a small, median tubercle. Fifth sternite very broadly and deeply concave before apex and apical margin strongly raised and carina-like. Plastron absent on disk of first sternite and apical depression of fifth but elsewhere complete. *Legs* with plastron absent on trochanters but complete on femora and tibiae. Front femur (fig. 4) twice as broad as hind femur (0.21 mm.: 0.10 mm.); front tibia with inner apex subcarinate. Middle tibia somewhat thickened and with hairs of cleaning fringe very long; middle tarsi thickened and all segments with fringes of dense, long, golden hairs.

Female. Unknown.

Holotype. ♂, Brazil: Paraná, Porto de Cima, Rio Ipiranga, xii.1958 (F. Plaumann).

Comparative notes. The very enlarged front femora together with a complete plastron on the tibiae will serve to distinguish this from all other described species. Its particular combination of male secondary sexual characters is not present in any other known species of *Neelmis*.

Neelmis atys, sp. n.

Male. Length, 2.3 mm.; breadth, 0.9 mm. Body subparallel. *Pronotum* across broadest point, which is at about basal third, as broad as long (0.70 mm.) and base broader than apex (0.60 mm.: 0.48 mm.). Side very broadly and not distinctly emarginate opposite transverse depression but distinctly and shallowly emarginate before basal angle. Lateral margin when seen from side double nearly to apex; slightly but distinctly wider at basal third than before or behind. Sublateral carinae prominent and ending about width of apex of first antennal segment from apical margin. Disk behind transverse depression twice as long as disk before depression (0.45 mm.: 0.19 mm.); transverse depression broad and deep; with a short median depression on anterior part of posterior disk that gradually widens as it joins transverse depression; anterior and posterior parts of disk with punctures about two-thirds as coarse as facets of eyes and usually separated by two to three diameters; bottom of transverse and median depressions with punctures very much denser, often contiguous; puncture on each side of middle of base about half as wide as scutellum. *Hypomera* smooth from anterior depression to about basal fourth and elsewhere with a reticulate microsculpture. *Elytra* twice as long as pronotum (1.45 mm.: 0.70 mm.) and base (across humeri) distinctly broader than pronotum (0.82 mm.: 0.70 mm.); feebly widened to broadest point at about apical third. Humeri feebly but distinctly gibbous. Strial punctures of basal discal region oval or round, nearly as broad as intervals, and separated longitudinally by little more than their diameters; with two basal accessory punctures between second and third striae. Discal intervals flat; surface sparsely, microscopically punctate. Scutellum flat, nearly round. *Prosternum* when seen from side with anterior three-fifths (not including process) only very slightly bent ventrally. Plastron absent, but all of sides with very long, often suberect, golden hairs (which are presumably a secondary sexual character of the male). Sides of process distinctly thickened. Carinae parallel. Lateral ridge prominent. *Metasternum* with posterior three-fourths of disk deeply, widely, and abruptly concave; sides of disk with numerous thick, recumbent setae; posterior margin on each side opposite mesal margin of coxa with a tuft of stout, erect setae. *Abdomen* with carinae of first sternite distinct and disk deeply concave. Plastron absent on disk of first sternite except for a narrow posterior belt; absent on anterior half or two-thirds of disk of second sternite; plastron elsewhere complete. *Legs* with plastron absent on trochanters and also on tibiae except for the usual cleaning fringes. Front tibiae with hairs of posterior cleaning fringe very

long; front tarsi with a ventral row of very long, erect, golden hairs on all five segments. *Genitalia* with parameres long, sharply pointed, and curved downwards (as in the *musgravei* species-group).

Female. Unknown.

Holotype. ♂, Brazil: Rio Grande do Sul, L. Vermelha, Rio Santa Rita, 800 m., iv.1959 (F. Plaumann).

Comparative notes. The structure of the male genitalia and the secondary sexual characters of the metasternal disk are those of the *musgravei* species-group. However, *N. atys* is larger than any member of the *musgravei* species-group, and the male differs from any other known male of the genus in having numerous long hairs on the prosternum and erect hairs on the ventral side of the front tarsi.

THE *Musgravei* SPECIES-GROUP

This species-group may be characterized as follows: Pronotum with a double lateral margin; sublateral carinae extending very nearly to apical margin; transverse depression deep; disk behind transverse depression slightly longer than disk before depression; convex parts of anterior and posterior parts of disk sparsely punctate. Hypomera with at least parts of middle smooth. Prosternum with plastron absent; a plastron often appears to be present on a very narrow belt along the lateral margin, but scanning electron micrographs of *N. mormo* show that there is no plastron here and that the appearance of a plastron is caused by extraneous material usually deposited in this area. Lateral ridge well developed. Legs without a plastron on trochanters or tibiae. Male always with a tuft of erect setae on each side of posterior margin of metasternum; each side of disk of metasternum with yellowish, subrecumbent setae except in *N. mormo*. The very large and distinctive *N. atys* might well be included in the *musgravei* species-group although some of its secondary sexual characters are very different. The males of the *musgravei* species group may be distinguished as follows:

1. Metasternum without coarse setae on sides of disk; tuft of erect setae on each side of posterior margin very large (Pl. II, fig. 1) and consisting of about 35 setae. Abdomen with plastron absent on anterior two-thirds of disks of second, third, and fourth sternites; fifth sternite with a deep, oval, apical pit that is about as wide as apex of hind tibia. Brazil (Paraná, Rio Grande do Sul) *Neelmis mormo*, sp. n.
- Metasternum with numerous coarse, yellowish, subrecumbent setae on each side of disk; tuft of erect setae on each side of posterior margin very much smaller and consisting of less than 30 setae. Abdomen with plastron complete on third and fourth sternites; fifth sternite without a median pit on apex 2
2. Male genitalia (fig. 12) with apices of parameres not sharply pointed. Hind trochanter (fig. 8) with ventral part before apex distinctly gibbous. Brazil (Santa Catarina, Paraná, Rio Grande do Sul) *Neelmis nicon*, sp. n.

- Male genitalia (fig. 11) with apices of parameres sharply pointed. Hind trochanter with ventral surface before apex not distinctly gibbous 3
- 3. Hypomera in front of anterior depression entirely microscopically reticulate, without a distinct smooth area. Prosternum with disk everywhere densely punctate. Brazil (Santa Catarina) *Neoelmis nelo*, sp. n.
- Hypomera in front of anterior depression with a large smooth area. Prosternal disk with a large area in front of carinae that has many of the punctures separated by two or more diameters 4
- 4. Hind leg with tibia distinctly longer than femur plus trochanter. Front leg with femur noticeably thickened. Metasternum with patch of subrecumbent yellowish setae widely separated on each side from tuft of erect setae on posterior margin. Brazil (Rio Grande do Sul, Paraná) *Neoelmis mila*, sp. n.
- Hind leg with tibia scarcely as long as femur plus trochanter. Front leg with femur not noticeably thickened, but, as usual, a little thicker than femora of middle and hind legs. Metasternum with patch of subrecumbent yellowish setae on each side of disk extending very nearly to tuft of erect setae on posterior margin. Brazil (Santa Catarina) *Neoelmis musgravei* Hinton (1940).

***Neoelmis mormo*, sp. n.**

(Pl. II, figs. 1-2; Figs. 5-7)

Male. Length, 1.8 mm.; breadth, 0.7 mm. *Pronotum* with a shallow and short median depression on apex of posterior part of disk; bottom of transverse depression and often also median depression with punctures usually more or less contiguous. *Hypomera* with area between depressions smooth and also with a large smooth area in front of anterior depression. *Prosternum* with a broad area in front of carinae where punctures are very much sparser than near middle anterior margin; carinae distinct and usually separated by less than half width of process. *Metasternum* (Pl. II, fig. 1) with disk very broadly and deeply depressed; sides of disk without the usual yellowish subrecumbent setae; erect tuft on each side of posterior margin with about 35 setae. *Abdomen* with disk of first sternite deeply depressed; fifth sternite with a deep, oval, apical pit that is about as wide as apex of front tibia. Plastron absent on disk of first sternite except for a narrow posterior belt; absent on anterior two-thirds of disks of second, third, and fourth sternites and also on anterior fifth of disk of fifth sternite.

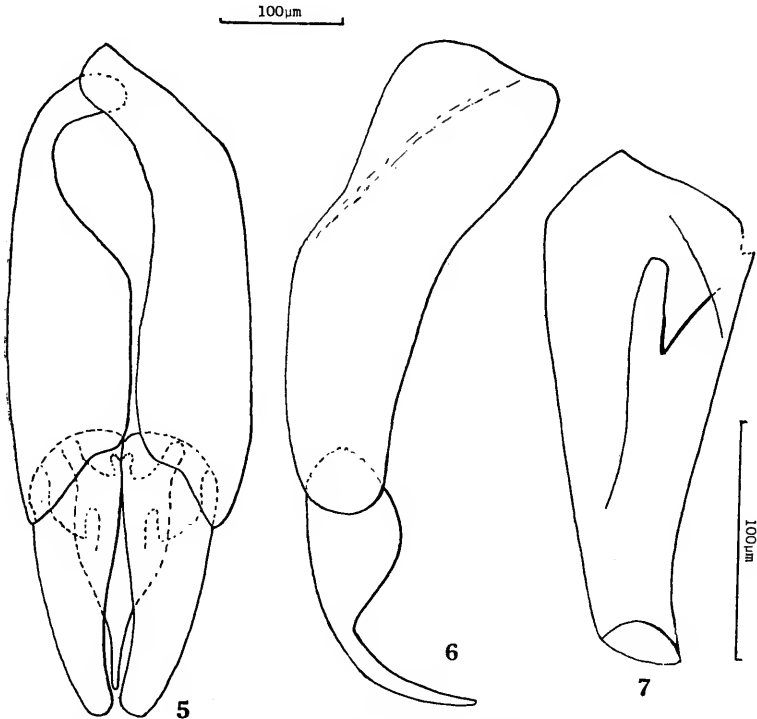
Female. Externally similar to male but (1) with disk of metasternum not as widely nor as deeply depressed; (2) without a tuft of erect setae on each side of posterior margin of metasternum; and (3) apex of fifth abdominal sternite without a pit.

Variations. In some males and females there are no dense punctures at the bottom of the deep transverse depression nor on the bottom of the shallow median depression of the pronotum. The form of the prosternal carinae varies greatly. In a few specimens

they are scarcely developed, whereas in a few others they are prominent and much more widely separated than noted above.

Holotype. ♂, Brazil: Rio Grande do Sul, Jaquirana, Rio Tainhas, 600 m, iv.1959 (F. Plaumann).

Paratypes. 7 ♂♂, 11 ♀♀, with same data as holotype; 5 ♂♂, 1 ♀, Rio Grande do Sul, Aparados, 1,000 m., iv.1959 (F. Plaumann); 4 ♂♂, 7 ♀♀, Rio Grande do Sul, Castilhos, Arroio Tipraia, 600 m., xi.1959 (F. Plaumann); 3 ♂♂, 2 ♀♀, Paraná, Boqueirão, 950 m., x.1959 (F. Plaumann); 1 ♂, Paraná, Sutil, Rio Caro, 850 m., x.1959 (F. Plaumann); 4 ♂♂, 2 ♀♀, Paraná, Rio do Campo, Guarapuava, 1,000 m., iii.1963 (F. Plaumann).



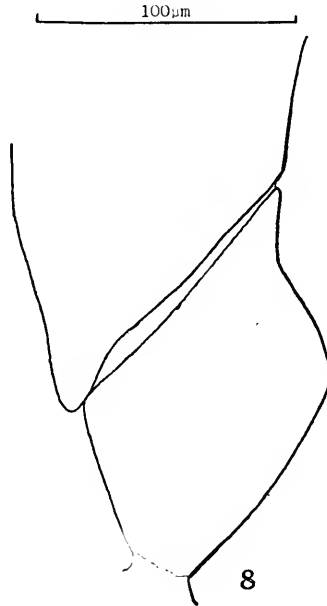
Neelmis mormo, sp. n.: 5, dorsal view of male genitalia; 6, lateral view of male genitalia; 7, inner view of a paramere.

***Neelmis nicon*, sp. n.**

(Figs. 8, 12)

Male. Length, 1.8 mm.; breadth, 0.7 mm. *Pronotum* with a very shallow, short, median depression on apex of posterior half of disk; bottom of transverse depression with a narrow belt of dense, microscopic punctures that extends over bottom of median

depression. *Hypomera* with area between depressions smooth and also with a median smooth area in front of anterior depression. *Prosternum* with a large median area in front of carinae where the punctures are very much sparser than elsewhere, often being separated by two to three or even more diameters; carinae usually distinct, parallel, and separated by nearly width of prosternal process, sometimes with carinae slightly converging anteriorly. *Metasternum* with a deep, broad, sharp-edged depression that extends from posterior margin to about anterior fifth of disk; anterior sides of disk distinctly gibbous; surface of each side of disk with a patch of yellowish, subrecumbent setae that extends very nearly to posterior tuft of erect setae on each side of posterior margin opposite mesal margin of coxa. *Abdomen* with disk of first sternite deeply depressed. Plastron absent on anterior four-fifths of disk of first sternite and anterior two-fifths of disk of second sternite. Hind leg with ventral part of trochanter before apex distinctly gibbous (fig. 8); hind tibia slightly longer than femur plus trochanter.



Neelmis nicon, sp. n.: 8, trochanter of hind leg of male.

Female. Externally similar to male, and with hind trochanter also gibbous on ventral side before apex, but differs in lacking the yellowish, subrecumbent setae on the metasternal disk and also the two tufts of erect setae near the posterior margin of the metasternum. The disk of the first abdominal sternite is less strongly depressed than in the male.

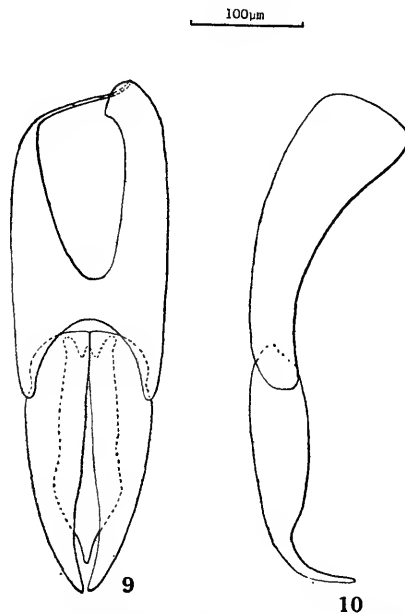
Holotype. ♂. Brazil: Santa Catarina, Nova Teutônia, 1970 (*F. Plaumann*).

Paratypes. 103 ♂♂, 86 ♀♀, with same data as holotype but some collected in 1971. The following were collected by F. Plaumann in Rio Grande do Sul: 16 ♂♂, 10 ♀♀, Rio Forquilha, L. Vermelha, 800 m., iv.1959; 3 ♂♂, 6 ♀♀, Rio Santa Rita, L. Vermelha, 800 m., iv.1959; 1 ♂, Sinimbu, 200 m., xi.1959; 10 ♂♂, 11 ♀♀, Castilhos, Arroio, Tipraia, 600 m., xi.1969; and 1 ♂, Espinilhos, 600 m., xi.1959. The following were collected by F. Plaumann in Paraná: 52 ♂♂, 64 ♀♀, Rio Azul, 900 m., x.1959; 8 ♂♂, 6 ♀♀, Rio Campo Novo, Guarapuava, 1,000 m., iii.1963; 1 ♂, 1 ♀, Rio das Mortes, Guarapuava, 1,100 m., iii.1963; 1 ♂, Rio Chalquin, Guarapuava, 1,200 m., iii.1963; 2 ♂♂, 1 ♀, Papagaios, 850 m., x.1959; 1 ♂, Arroio Lambedor, near Mariópolis, i.1958; 1 ♂, Laranjeiras, 500 m., iii.1963; 5 ♂♂, Lageado do Pinheiro, 1.1958.

Neelmis nelo, sp. n.

(Figs. 9-10)

Male. Length, 1.8 mm.; breadth, 0.7 mm. *Pronotum* with a shallow and short median depression on apex of posterior half of disk; bottom of transverse depression with a moderately narrow belt of dense, more or less contiguous punctures, this belt being 3 to 4 punctures wide at sides and about 10 to 15 punctures wide at middle where it extends into the shallow, median depression.



Neelmis nelo, sp. n.: 9, dorsal view of male genitalia; 10, lateral view of same.

Pronotum between median basal punctures carina-like. *Hypomera* with an extensive, smooth, middle area between depressions but elsewhere microscopically reticulate; without a distinct smooth area in front of anterior depression. *Prosternum* everywhere densely punctate; punctures sometimes very slightly sparser on discal area in front of carinae but here never as widely separated as in other members of the *musgravei* species-group. Carinae distinct, subparallel. *Metasternum* with a deep, broad, sharp-edged depression that extends from posterior margin to about anterior fifth of disk; surface of disk on each side with a patch of yellowish, subrecumbent setae that extends almost to tuft of erect setae opposite mesal margin of hind coxa. *Abdomen* with disk of first sternite deeply depressed. Plastron absent on anterior four-fifths of disk of first sternite and on anterior half of disk of second sternite.

Female. Externally similar to male but the metasternal disk lacks the yellowish, subrecumbent setae and the two posterior tufts of erect setae. The disk of the first abdominal sternite is much less strongly depressed than in the male.

Holotype. ♂, Brazil: Santa Catarina, Nova Teutônia, 1970 (*F. Plaumann*).

Paratypes. 3 ♂♂, 1 ♀, with same data as holotype.

Neoelmis mila, sp. n.

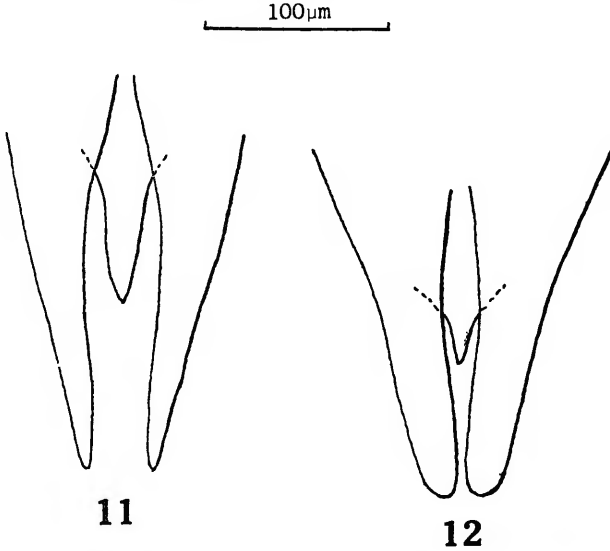
(Fig. 11)

Male. Length, 1.9 mm.; breadth, 0.8 mm. *Pronotum* with a shallow, short, median depression on apex of posterior half of disk; bottom of transverse depression with a well-marked belt of dense punctures. Pronotum between median basal punctures not subcarinate. *Hypomera* mostly smooth between depressions; with a moderately large, smooth, median area in front of anterior depression and a smaller smooth area behind posterior depression. *Prosternum* with a broad, sparsely punctate area in front of carinae. Carinae distinct and parallel in some specimens but distinctly converging anteriorly in others. *Metasternum* with a deep, broad, sharp-edged depression that extends from base to about anterior fourth of disk; surface of each side of disk with a patch of yellowish, subrecumbent setae that is widely separated from posterior tuft of erect setae opposite mesal margin of hind coxa. *Abdomen* with disk of first sternite strongly depressed on anterior four-fifths. Plastron absent on anterior four-fifths of disk of first sternite and anterior half of disk of second sternite. *Legs* with front femora distinctly thicker than middle or hind femora and at middle almost circular in section instead of oval (because of their shape they appear to be thicker than they in fact are: as compared with the middle femora they are 0.15 mm.: 0.12 mm. thick); hind leg with tibia slightly but distinctly longer than femur plus trochanter.

Female. Externally similar to male but metasternal disk without the patches of yellowish, subrecumbent setae or the posterior tufts of erect setae. The female has the front femora less thickened than in the male, and the disk of the first abdominal sternite is not as deeply concave.

Holotype. ♂, Brazil: Rio Grande do Sul, Castilhos, Arroio Tipraia, 600 m., xi.1959 (F. Plaumann).

Paratypes. 1 ♂, with same data as holotype; 2 ♂♂, Rio Grande do Sul, Candelaria, 150 m., ix.1959 (F. Plaumann); 1 ♂, Rio Grande do Sul, Caxias do Sul, 700 m., xi.1959 (F. Plaumann); 1 ♂, Paraná, Papagaios, 850 m., x.1959 (F. Plaumann); and 2 ♂♂, 1 ♀, Paraná, Rio Chalquim, Guarapuava, 1,200 m., iii.1963 (F. Plaumann).



Neoelmis mila, sp. n.: 11, apex of male genitalia.
Neoelmis nicon, sp. n.: 12, apex of male genitalia.

THE *Maculata* SPECIES-GROUP

This very distinctive species-group includes all species of *Neoelmis* that have the elytra, and often also the pronotum, distinctly maculate. All of the species have the prosternal carinae more widely separated than the middle coxae, and there is no trace of a lateral ridge on the prosternum. The trochanters always have a plastron — a very distinctive feature in *Neoelmis* — and the tibiae are without a plastron but have the usual cleaning fringes. This species-group is closely related to the *limosa* species-group. The four members of the *maculata* species-group may be distinguished as follows:

1. Abdomen with short but distinct discal carinae on first sternite. Brazil (Amazonas, Santa Catarina)
 *Neoelmis maculata* Hinton (1940)
- Abdomen without discal carinae on first sternite 2
2. Pronotum with sublateral carinae extending only to about apical fourth. Brazil (Mato Grosso) *Neoelmis mamorata* Hinton (1940)

- Pronotum with sublateral carinae extending very nearly to apical margin 3
- 3. Male with a small median tubercle on posterior fifth of disk of first abdominal sternite. Male genitalia (fig. 13) with apices of parameres somewhat truncate. Ecuador *Neelmis anytis*, sp. n.
- Male without a tubercle on disk of first abdominal sternite. Male genitalia (fig. 14) with apices of parameres rounded. Bolivia *Neelmis opis*, sp. n.

Neelmis anytis, sp. n.

(Fig. 13)

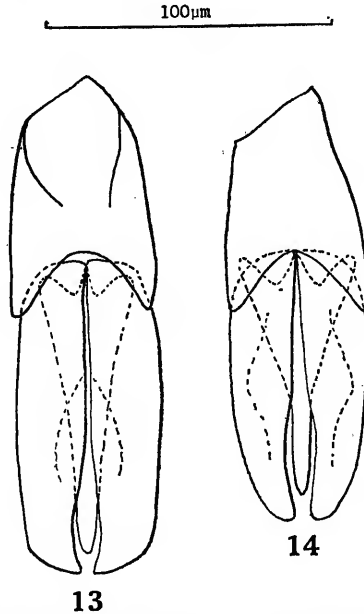
Male. Length, 1.45 mm.; breadth, 0.58 mm. Body subparallel. Cuticle reddish brown; head between eyes often black; pronotum behind transverse depression usually black or nearly so; elytra black or nearly black; each elytron with (1) a large yellowish patch extending over humerus and adjoining area; (2) a large yellowish patch on apical third extending over sublateral carina; and (3) extreme apex and often lateral margin of apical third also yellowish. *Pronotum* across broadest point, which is at about basal third, no broader than long (0.40 mm.) and base broader than apex (0.38 mm.: 0.30 mm.). Side moderately arcuate on both basal and apical halves; very shallowly, arcuately emarginate opposite transverse depression; nearly straight before basal angle. Lateral margin when seen from side double but with lower edge much less distinct than upper edge. Sublateral carinae prominent and extending very nearly to apical margin. Disk behind transverse depression longer than disk before depression (0.24 mm.: 0.18 mm.); anterior and posterior convex parts of disk with recumbent setae about as long as third antennal segment arising from punctures that are usually separated by about five diameters. Disk at base between sublateral carinae with a flattened strip about two-fifths as long as scutellum; puncture on each side of middle of base small and widely separated from each other so that there is no appearance of a carina between them. *Hypomera* with all of middle area between anterior and posterior depressions, including surface of depressions, smooth; surface elsewhere microscopically reticulate. *Elytra* more than twice as long as pronotum (1.05 mm.: 0.40 mm.) and across base much wider than pronotum (0.48 mm.: 0.40 mm.): moderately widened to broadest point at about apical two-fifths. Humeri moderately feebly gibbous. Strial punctures of discal region round, slightly narrower than intervals, and separated longitudinally by more than their diameters; near base punctures of second to fourth striae inclusive very much smaller than those of sutural stria; between second and third striae at base with an accessory row of five to seven small punctures. Discal intervals flat; surface of intervals setose like pronotum. Scutellum flat, obovate. *Prosternum* when seen from side with anterior three-fifths (not including process) sharply bent ventrally. Plastron absent except for a very narrow belt along lateral margin. Process between coxae about as wide as apical antennal segment is long. Prosternal carinae prominent, slightly diverging, and far apart, the

distance between them being more than width of hypomera. Lateral ridge absent. *Metasternum* with median longitudinal line nearly complete; on posterior three-fifths deep and almost as wide as apex of middle tibia. Plastron extending across disk up to median longitudinal line. *Abdomen* without discal carinae on first sternite; disk of first sternite with a small, low, median tubercle on about posterior fifth; anterior third of disk depressed. Plastron absent only on depressed anterior part of disk of first sternite. *Legs* with plastron complete on trochanters and femora but absent on tibiae.

Female. Externally similar to male but without a median tubercle on disk of first abdominal sternite and with anterior part of disk not as strongly depressed.

Holotype. ♂, Ecuador: Dept. of Pastaza, Rio Cusuimi, 150 km. southeast of Poyo, at light, v.1971 (B. Malkin).

Paratypes. 4 ♂♂. 4 ♀♀, with same data as holotype.



13, dorsal view of male genitalia of *Neelmis anytis*, sp. n.
14, same of *N. opis*, sp. n.

Neelmis opis, sp. n.

(Fig. 14)

Male. Length, 1.4-1.5 mm.; breadth, 0.55-0.60 mm. Similar in colour and structure to *N. anytis* but without a median tubercle near posterior margin of disk of first abdominal sternite. The two species also differ in the structure of the male genitalia (cf. figs. 13 and 14).

Female. Externally similar to male but with anterior part of disk of first abdominal sternite less strongly depressed.

Holotype. ♂, Bolivia: Dept. of Santa Cruz, Prov. Sara, Santa Rosa, at light, ii.1969 (A. Martinez & R. E. Woodruff).

Paratypes. 3 ♂♂, 5 ♀♀, with same data as holotype.

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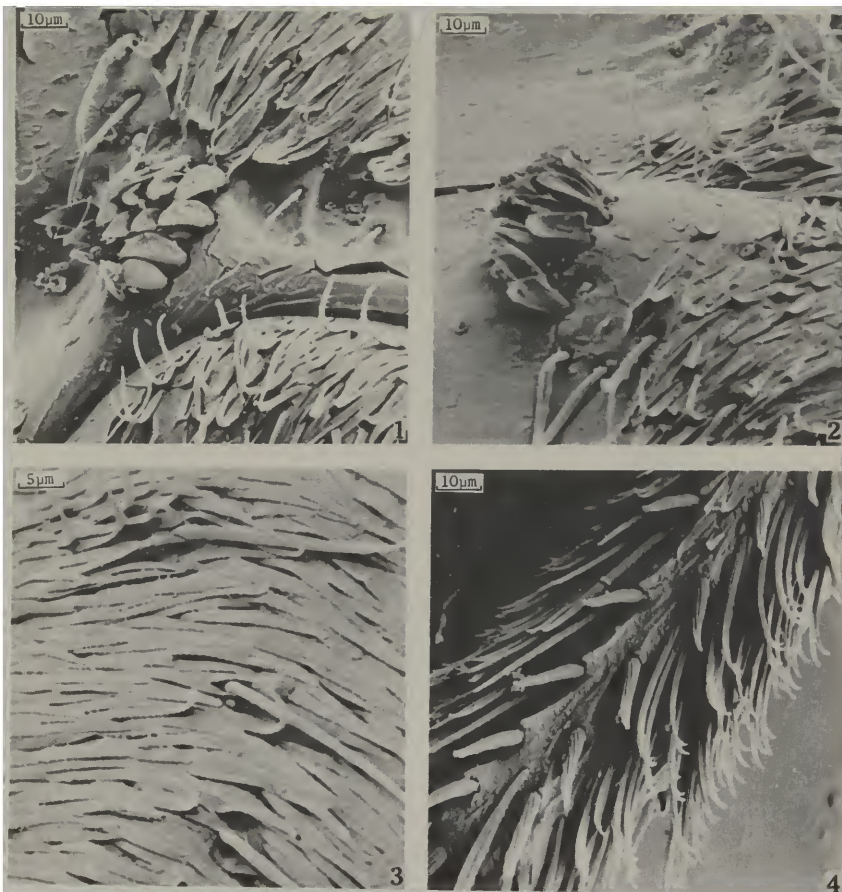


Plate I. Scanning electron micrographs of the male of *Neelmis reichardtii* sp. n.: 1, tuft of setae on left side of posterior margin of metasternal disk. 2, tuft of setae on left side of second abdominal sternite. 3, plastron of side of second abdominal sternite. 4, inner view of apex of middle tibia showing anterior and posterior cleaning fringes.



Plate II. Scanning electron micrographs. 1, metasternal disk of male of *Neoelmis mormo*, sp. n.. 2, tuft of erect setae of right side of posterior margin of metasternal disk of same species. 3, the tuft of erect setae of the left side of the posterior margin of the metasternal disk of the male of *Neoelmis maro*, sp. n.. 4, tuft of setae of one side of the disk of the second abdominal sternite of the male of the same species.

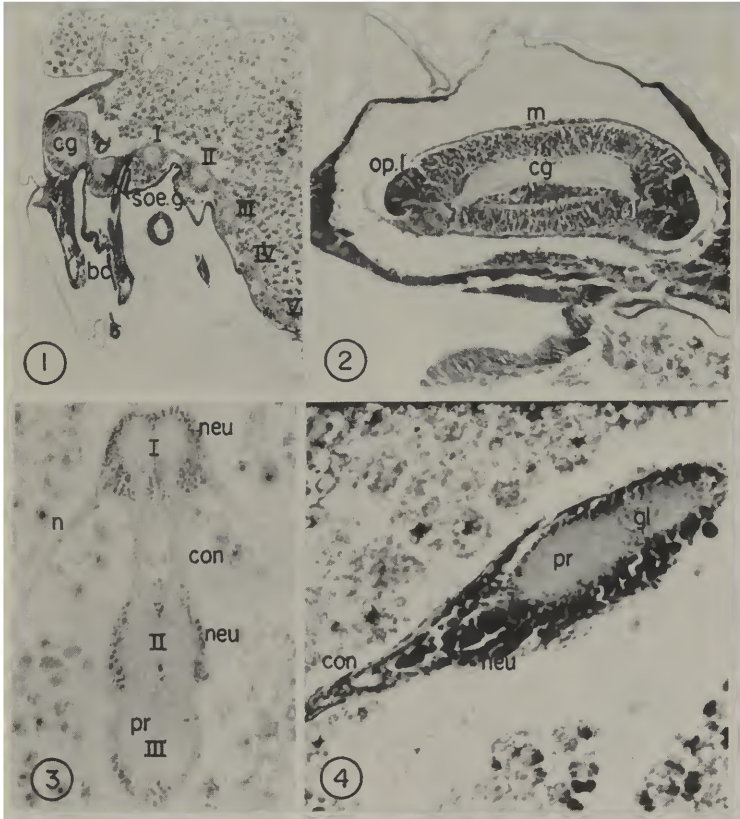


Plate IV. 1, V instar larva, nervous system showing the nervous disposition in the different ganglia (35x). 2, cerebral ganglion from prepupa (cg), frontal view (150x). 3, frontal longitudinal section of thoracic ganglia of late prepupa, showing neurones in the periphery and the nerve process in the medullar region (150x). 4, last abdominal ganglion from white eyed pupa (150x). cg. = cerebral ganglion; bc = bucal cavity; soe.g. = suboesophageal ganglion; op.l. = optic lobe; m = wrapping membrane, meninge; neu. = neurones; n = nerve; con. = connective; pr. = nerve process; gl. = glial cells.

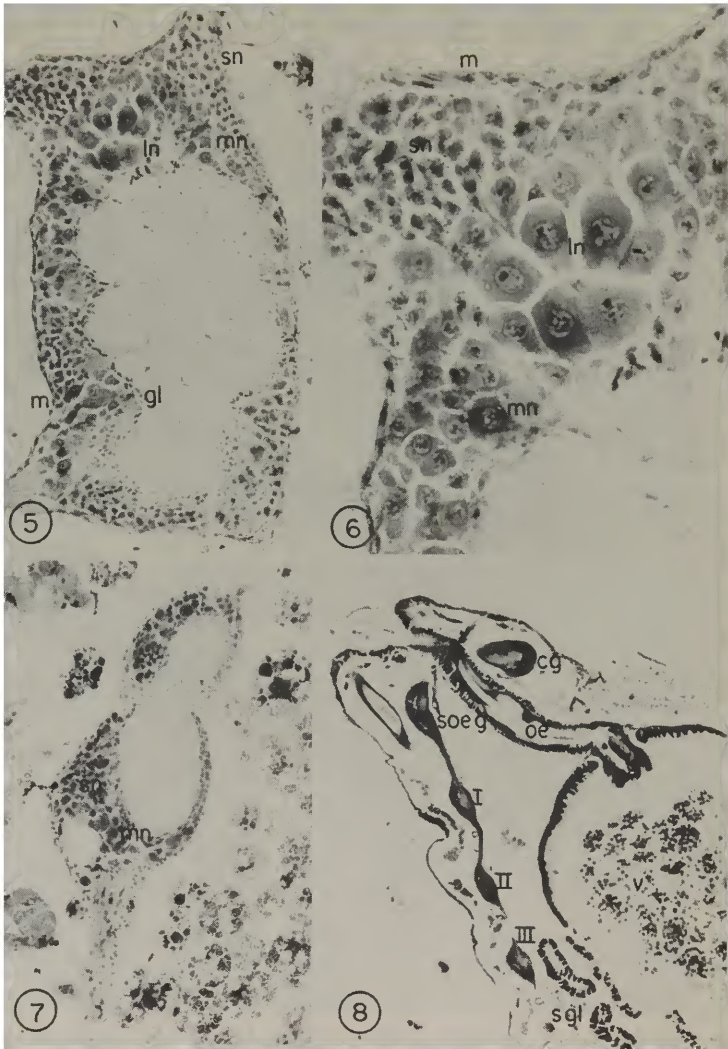


Plate V. 5, 3 different types of neurones in the first thoracic ganglion (360x). 6, high magnification of 5, showing differences in nuclei (550x). 7, last abdominal ganglion of white eyed pupa, showing small and middle sized neurones (230x). 8, anterior nervous system of III instar larva (60x). sn = small neurones; m.n. = median neurones; ln. = large neurones; oe = oesophagus; sgl = salivary glands.

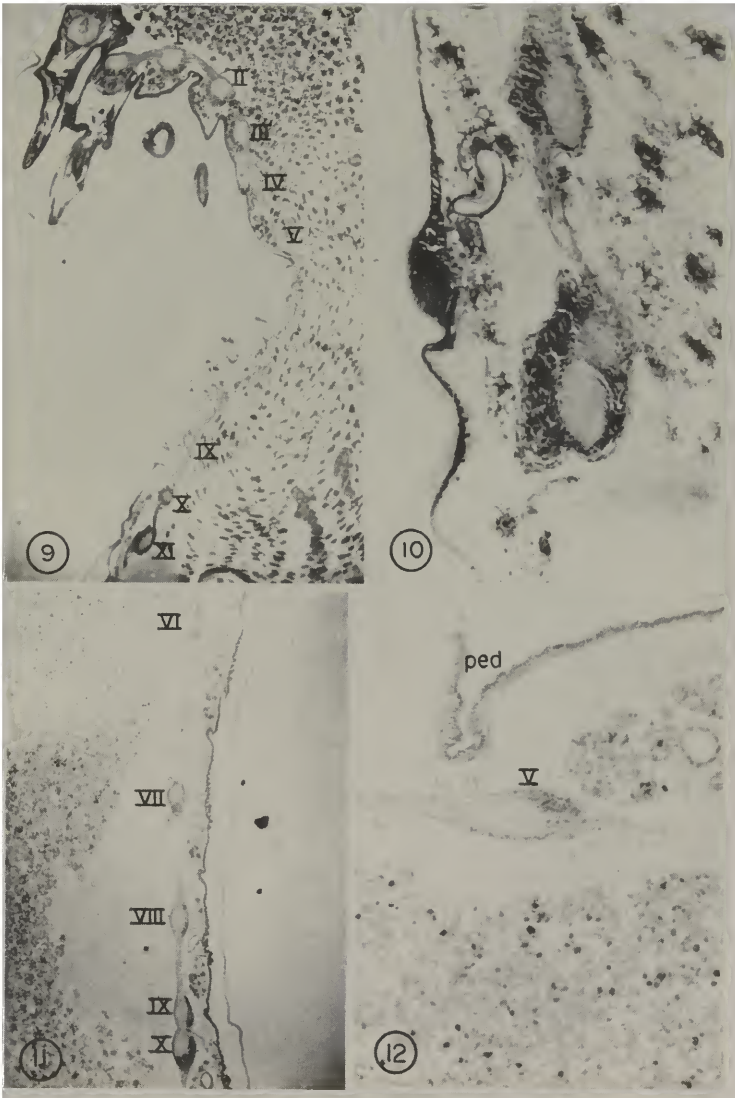


Plate VI. 9, V instar larva, nervous chain (35x). 10, V instar larva, last abdominal ganglion showing that it results from the fusion of 2 ganglia (230x). 11, terminal portion of ventral chain of early prepupa (60x). 12, second abdominal ganglion (fifth of the ventral chain), migrating to thorax (150x). ped = pedicell.

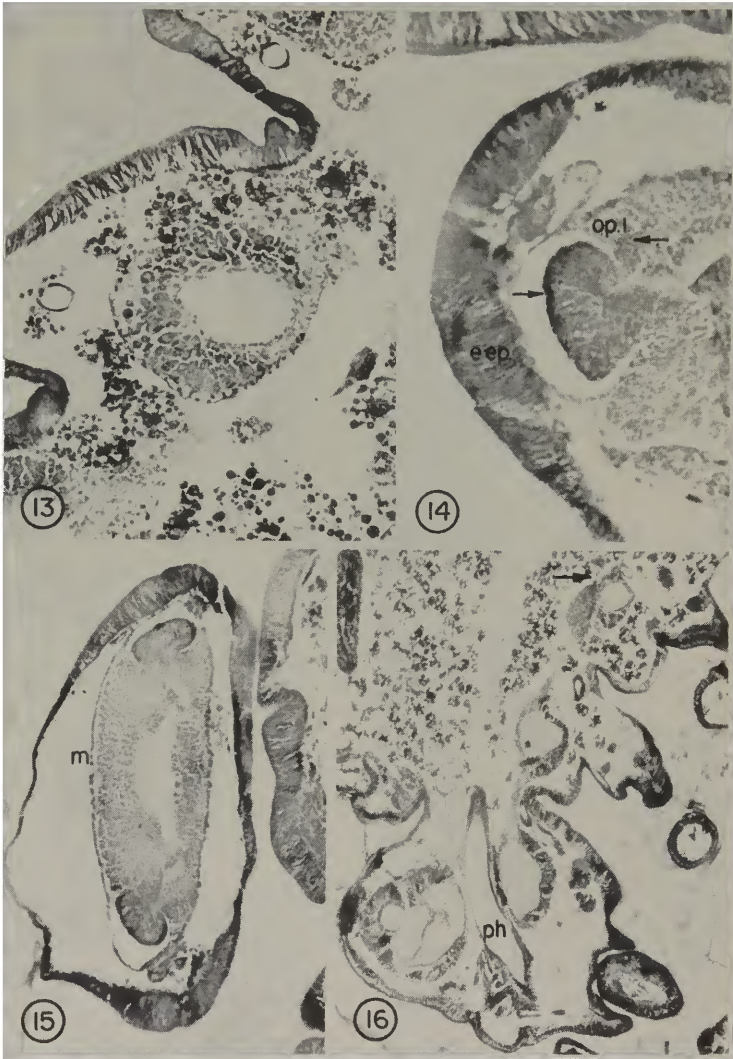


Plate VII. 13, First thoracic ganglion of late prepupa; no differentiation in neurones is present in this stage (230x). 14, optic lobes of same prepupa showing mitosis (arrows) (150x). 15, frontal section of head of prepupa showing optic lobes and epithelial part of the compound eye in differentiation (35x). 16, fusion of second and third thoracic ganglia in early prepupa (55x). e.ep. = eye epithelium; ph = pharynx.

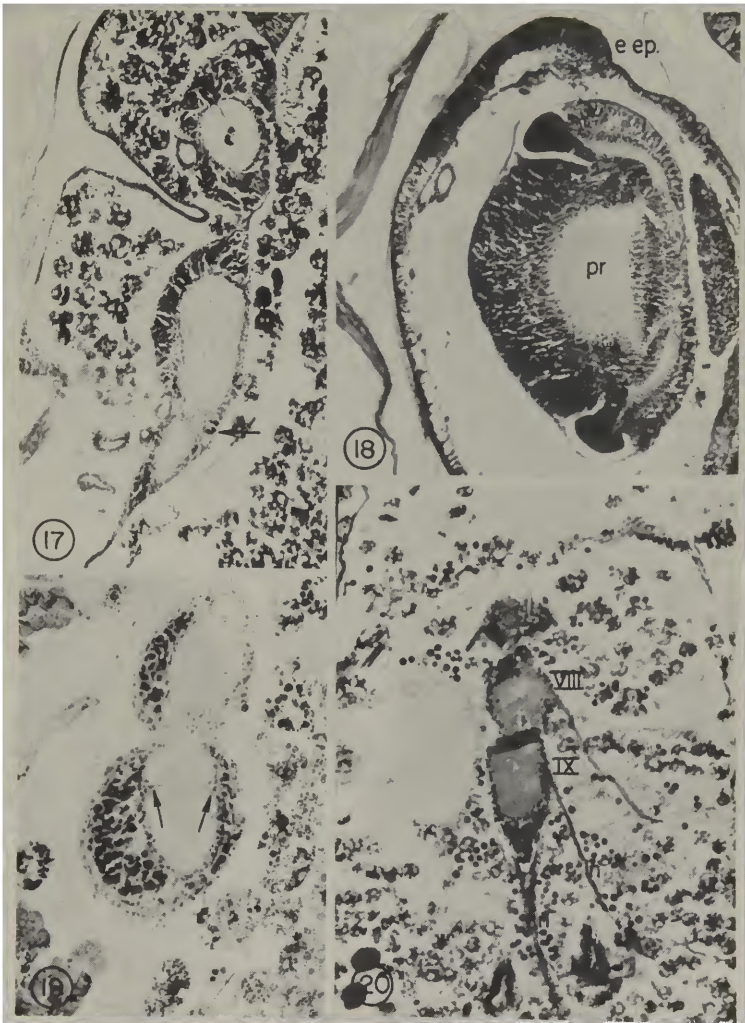


Plate VIII. 17, fusion of third and fourth ganglia (first abdominal) in the thorax of late prepupa (arrow) (55x). 18, brain of late prepupa (150x). 19, last abdominal ganglion of white eyed pupa showing signs of ganglionar fusion (arrows); this ganglion is bearing a new fusion (230x). 20, frontal section of pupa of same age, showing the nerves leaving the ganglia (150x). n = nerves.

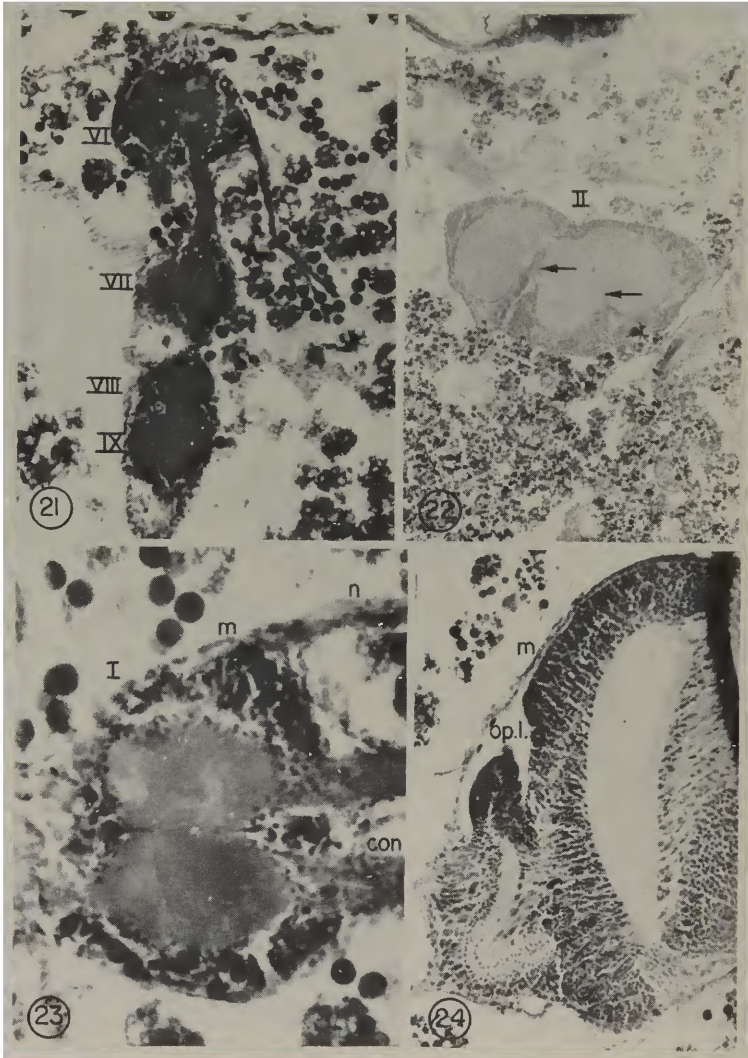


Plate IX. 21, frontal section of posterior abdominal ganglia of pink eyed pupa (150x). 22, lateral section of pupa of same age, showing the second thoracic ganglion as resultant of fusion of 3 ganglia (150x). 23, first thoracic ganglion in the beginning of neuronal differentiation (230x). 24, optic lobe of white eyed pupa (230x).

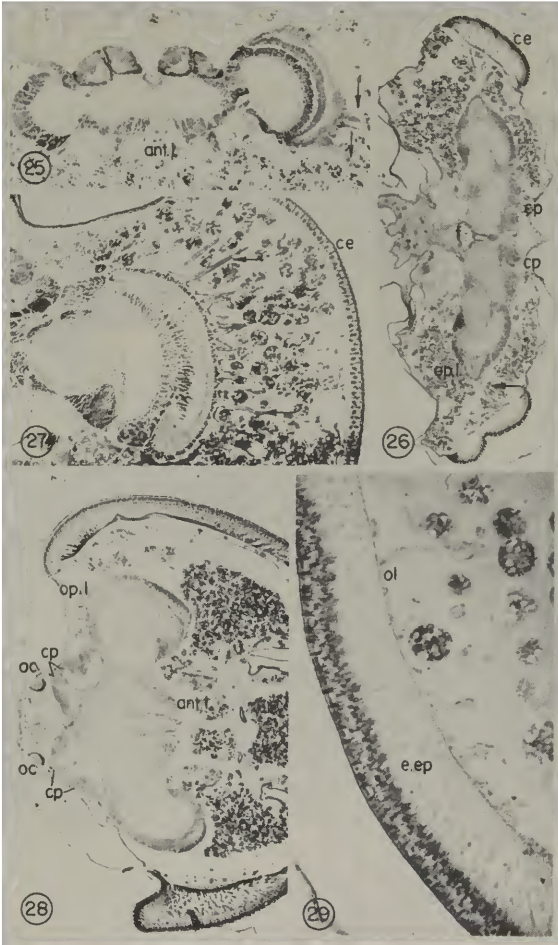


Plate X. 25, brain of pink eyed pupa, with all parts already formed; note the nervous processes leaving the optic lobe (arrows) (35x). 26, brain of red eyed pupa in frontal section showing the epithelial part of the compound eye already differentiated and connected to nervous part (35x). 27, brain of same aged pupa in sagittal section, showing the optic nerves (arrows) (60x). 28, brain of brown eyed pupa showing ocelli (35x). 29, compound eye of same pupa (150x). ant.l. = antennal lobe; ce = compound eye; cp = corpora pedunculata; f = foramen.

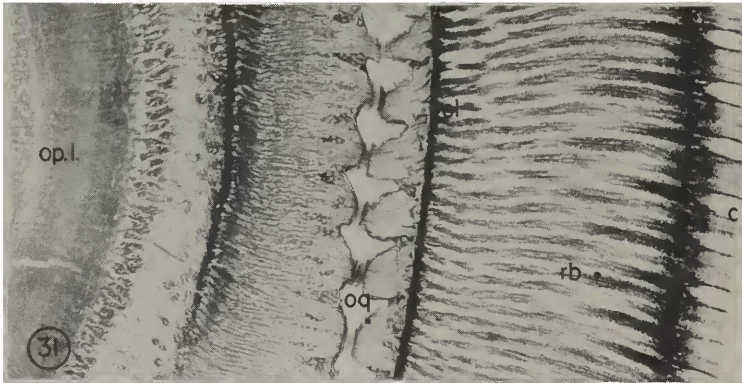
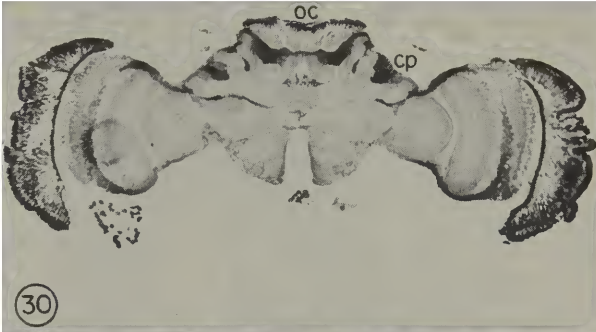


Plate XI. 30, brain of adult bee; note that the attachment between the epithelial and nervous part of eye is such that they come together in dissection (230x). 31, compound eye and part of the optic lobe of adult (230x). c = cornea; rb = rhabdome; ol = outer limitant; o.q. = optic quiasm; il = inner limitant.

