

ON THE AUSTRALIAN FERN WEEVILS.

By GUY A. K. MARSHALL, C.M.G., D.Sc.

(Plates VI-VIII.)

The weevil, *Syagrius fulvitaris*, Pasc., has been known for some time as an enemy of ferns, Mr. W. W. Froggatt having found it abundantly attacking ferns both in greenhouses and in the open in the Botanic Gardens at Sydney.

In 1902 another species, *S. intrudens*, Waterh., was found to be doing serious damage to greenhouse ferns in the Royal Botanic Gardens, Dublin, and Prof. G. H. Carpenter recorded that in 1912 it had actually established itself and was breeding in the open (Econ. Proc. R. Dublin Soc., ii, no. 6, Aug. 1913). There can be little doubt that this species must have been introduced from Australia, but its original home has not yet been ascertained, and Dublin remains as the only locality from which it has been recorded.

In 1904 yet another species belonging to a different genus, *Neosyagrius cordipennis*, was described by Mr. A. M. Lea, the insect having been found by Mr. W. W. Froggatt damaging maidenhair ferns in the Botanic Gardens at Sydney.

Since about 1905 *Syagrius fulvitaris* has been known to occur in the Hawaiian Islands in the vicinity of Honolulu, but it does not appear to have attracted any special attention until the last few years, when it has begun to spread to a somewhat disquieting extent and has started to attack the fern forests, the destruction of which might seriously affect the water supply. As the attempts to control it have not been altogether satisfactory, the Hawaiian Sugar Planters' Experiment Station arranged to send Mr. C. E. Pemberton to New South Wales in order to discover and bring back parasites of the weevil, a task which he has successfully accomplished.

Mr. Pemberton also brought back a number of the weevils found attacking wild ferns, and these have been kindly submitted to me by Mr. F. Muir for identification. The material, upon examination, proved to comprise no less than seven different species, namely, *Syagrius fulvitaris* and four undescribed species of the genus, and two new species of *Neosyagrius*; neither *S. intrudens* nor *N. cordipennis* was represented. One of the new species of *Syagrius*, represented by a single specimen, is not dealt with here because examples of it have already been submitted by Mr. Pemberton to Mr. A. M. Lea, who proposes to describe it.

The types of the new species will be deposited in the British Museum, and in those cases in which there is more than one specimen there are cotypes in the collection of the Hawaiian Sugar Planters' Experiment Station.

Key to the Species of Syagrius, Pasc.

- 1 (4). Interval 3 of elytra with a rounded granular tubercle at a little distance from the base.
- 2 (3). Funicle with joint 2 much longer than 1; dorsal outline of pronotum almost straight (apart from the median tubercles), but sloping markedly upwards in front; tubercles on elytra high and well marked, the intervals on the inflexed margins without granules *fulvitaris*, Pasc.
- 3 (2). Funicle with the two basal joints subequal; dorsal outline of pronotum markedly convex; tubercles on elytra low and mostly ill-defined, the lateral intervals with flattened shiny granules *intrudens*, Waterh.
- 4 (1). Interval 3 of elytra with a large elongate granular tubercle that extends right up to the base.

- 5 (8). Rostrum not constricted at the base; femora rugosely granulate; tarsi clothed above with very fine hairs.
- 6 (7). Funicle with the two basal joints subequal; elytra not constricted at the base, the lateral intervals entirely without granules. . . . *costicollis*, sp. n.
- 7 (6). Funicle with joint 2 distinctly longer than 1; elytra constricted at the base, the lateral intervals with flattened shiny granules . . . *pembertonii*, sp. n.
- 8 (5). Rostrum shallowly constricted laterally at the base; femora not granulate, almost smooth; tarsi clothed above with long stout flattened fulvous setae *squamipes*, sp. n.

***Syagrius costicollis*, sp. nov. (Plate vi, fig. 3).**

♂♀.—Integument dull black, without scaling, but with sparse fulvous setae. *Head* very minutely aciculate on the vertex and with very shallow, sparse punctures; the forehead very coarsely punctate, with two low median elevations separated by a rather deep depression. *Rostrum* with the whole surface minutely aciculate, and therefore opaque in the ♂, but the dorsal area more shiny in the ♀; coarsely and closely punctate, except on the apical area, on which the punctures are small, shallow and separated (♂), or more or less longitudinally confluent (♀); the dorsal area rather indistinctly tricarinate, the outer carinae uniting into a point at the base, and the dorsal outline strongly and regularly curved; a deep, straight, shallowly punctate furrow on each side above the scrobe. *Antennae* red-brown; the two basal joints of the funicle subequal, the remainder slightly transverse, joint 7 more distinctly so; the basal joint of the club shorter than the rest of the club. *Prothorax* a little broader than long, strongly rounded at the sides, widest well before the middle, the anterior dorsal margin gently arcuate; a broad, smooth, flat median costa that reaches neither base nor apex, the remainder of the surface coarsely and confluent punctate, and the ridges between the punctures subtuberculate, there being two median tubercles higher than the rest, one on each side of the costa; the apices of most of the tubercles shiny, the rest of the surface opaque; a few sparse, short, recumbent setae, these being denser along the basal margin. *Elytra* suboblong, the sides not narrowed or constricted at the base; the rows of punctures shallow and rather irregular on the disk, much deeper and quite regular laterally; interval 1 bearing a few, irregularly spaced, minute granules along the suture; interval 2 narrow and very indefinite, with still fewer and variable granules; interval 3 with a large elongate basal tubercle set with shiny granules, a few granules at the middle, a slightly raised cluster of granules just behind these, a large rounded granular tubercle at the top of the declivity rather densely clothed with fulvous setae, and an elongate granular tubercle on the declivity; interval 4 almost without granules; interval 5 with irregular clusters of granules throughout, the one at the top of the declivity tuberculate and elongate; interval 6 almost smooth; interval 7 with a row of indistinct granules and a small tubercle at its apex; the lateral intervals devoid of granules. *Legs* rugosely granulate; the femora with an indefinite ring of pale setae at one-third from the apex; the tarsi red-brown.

Length, 3.4–5 mm.; *breadth*, 1.25–1.85 mm.

NEW SOUTH WALES: Nimbin, near head waters of Richmond River, iv.1921 (*Pemberton*).

Described from 28 specimens.

Readily distinguished from both the previously described species of *Syagrius* by the form of the basal tubercle on interval 3 of the elytra, which is elongate and extends right up to the base so that its upper surface continues the level of the dorsal outline (*cf.* Plate vi, fig. 4, *a*); whereas in the other two species this tubercle is rounded and placed at an appreciable distance from the base (Plate vi, fig. 6, *a*). It is further distinguished from all the species here dealt with by the fact that the elytra are not narrowed or constricted at the base.

Syagrius pembertoni, sp. nov. (Plate vi, fig. 4).

♂ ♀.—Integument dull black, with shiny granules, and sparsely set with short, recumbent, fulvous setae.

Head with the vertex very finely and transversely aciculate and sparsely set with minute flattened granules; the forehead broadly tumid, covered with larger shiny granules and with a shallow median longitudinal impression. *Rostrum* almost straight in the basal half and then strongly curved, rather thicker dorso-ventrally in the ♂, but otherwise similar in the two sexes, with coarse reticulate punctation, except on the apical area, which is shining and finely punctate; the dorsum with a very ill-defined median carina, without definite lateral carinae, and not narrowed to a point at the base; a deep longitudinal furrow just above the scrobe. *Antennae* red-brown; the funicle with joint 2 much longer than 1, the remainder about as long as broad; the basal joint of the club as long as the remainder. *Prothorax* a little broader than long, strongly rounded at the sides, broadest slightly before the middle, the anterior dorsal margin distinctly arcuate; the whole surface deeply and rugosely punctate, most of the spaces between the punctures bearing a shiny granule, the granules being more numerous along the front margin, and in the middle of the disk two low, granular tubercles, between which there is often an abbreviated, flat, smooth line; on each side of the dorsum a curved stripe, formed of fulvous setae, extending from the base to about two-thirds of the length. *Elytra* oblong-ovate, narrowed and shallowly constricted at the base, thence nearly parallel-sided to far beyond the middle, the basal angles slightly projecting; the punctures moderately deep, in quite regular rows and each containing a recumbent fulvous seta; interval 1 with an intermittent row of minute granules, and with rather numerous fulvous setae on the posterior half; interval 2 with a row of larger shiny granules (often irregularly duplicated) beginning at one-fourth from the base and ending not far behind the middle, this portion often slightly elevated and sometimes broadly interrupted in the middle; interval 3 with a very large elongate basal tubercle, which is broadest and slightly projecting at the base and tapers to a point behind, being densely covered with shiny granules; at or behind the middle on interval 3 an elongate aggregation of granules, at the top of the declivity a larger granular tubercle, and a smaller rounded or elongate one on the declivity; interval 4 with two groups of granules similar to and in about the same position as those on interval 2; interval 5 with a cluster of granules near the base, another at the middle, and a low, granular tubercle at the top of the declivity; intervals 6 and 7 with scattered smaller granules, and the lateral intervals with rows of sparse, shiny dots representing obsolescent granules. *Legs* coarsely granulate, with sparse, small, pale, recumbent setae; tarsi red-brown.

Length, 5–6.25 mm.; *breadth*, 1.75–2.5 mm.

NEW SOUTH WALES: Nimbin, iv.1921 (type), and Dunoon, near Lismore, iv.1921 (*Pemberton*).

Described from 17 specimens.

Syagrius squamipes, sp. nov. (Plate vi, fig. 2).

♂.—Integument dull black, without scaling, but with numerous short, stout, recumbent, fulvous setae; the elytra with a few whitish squamiform setae at the basal junction of intervals 7 and 9, and an indefinite stripe of similar pale setae running from the summit of the tubercle at the top of the declivity on interval 3 obliquely forwards to the suture, forming with its fellow a faint chevron-shaped marking.

Head with fairly large, very shallow punctures throughout, except on the extreme vertex, which is transversely striolate; the forehead without prominences, but strongly convex and with a deep longitudinal median fovea. *Rostrum* fairly strongly curved and with a shallow basal constriction on each side in front of the eye; the dorsal area with irregular subconfluent setigerous punctures as far as the antennae,

without any median carina (except for a trace anteriorly), and the feeble lateral carinae converging to a distinct point at the base; the lateral area with two rows of deep setigerous punctures, but lacking the usual deep furrow above the scrobe; the apical area very shiny and distinctly but unevenly punctate. *Antennae* piceous; the funicle with joint 2 longer than 1, the others all a little longer than broad. *Prothorax* somewhat transverse, strongly rounded at the sides, broadest at the middle, and the anterior dorsal margin subtruncate; the whole surface set with large rounded tubercles of unequal size, most of them having a minute shiny granule at the summit, but without the usual two higher tubercles in the middle; the dorsal outline rising gradually from the apex to well behind the middle, then falling rapidly, the base being well below the level of the apex. *Elytra* slightly pyriform, shallowly constricted at the base, then very gradually widening posteriorly, being widest at three-fourths the length, the basal angles projecting laterally; the punctures very large and deep, and in fairly regular rows even on the disk; intervals 3, 5 and 7 more or less tuberculate, the others plane and not even granulate, all the tubercles bearing a few minute shiny granules; interval 3 with a large elongate basal tubercle (the basal margin being there produced slightly forwards), followed by three subtuberculate groups of granules, then a large rounded tubercle at the top of the declivity, and an elongate elevation on the declivity itself; intervals 5 and 7 with the tubercles well marked behind, but becoming much reduced or obsolete towards the base. *Legs* almost smooth, the femora with some very shallow punctures at the apex and base, and with sparse, fulvous setae, and an ill-defined ring of paler setae on the thickened portion; the tibiae with dense, raised squamiform fulvous setae; the tarsi black, and with similar setae instead of the usual fine hairs.

Length, 8.5 mm.; *breadth*, 3.5 mm.

NEW SOUTH WALES: Nimbin, 20.iv.1921 (*Pemberton*).

Described from a single male.

This is the largest species of the genus and differs from all the others in the following points:—The basal constriction of the rostrum and the absence of the deep lateral furrow; the comparatively smooth legs, and the dense squamiform setae on the tibiae and tarsi.

In the genus *Syagrius* the genitalia of both sexes afford good diagnostic characters (*cf.* Plates vii, viii). In the males the median lobe is in the form of a shallow trough with only the lateral and anterior edges heavily chitinised; the dorsal surface of the tube is entirely membranous, and on the ventral portion there is a lightly chitinised, elliptical or ovate area, above which lie two short, slightly curved rods, which are pointed posteriorly; the median struts are continuous with the lateral margins of the median lobe, thin and sinuate dorso-ventrally at the junction with the lobe, but compressed distally and more or less spatulate at the apex; the length of the struts in relation to that of the median lobe is as follows in the various species (using the same unit of measurement throughout, 8 units = 1 mm.):—*S. fulvitaris*, 8 : 5; *S. intrudens*, 11 : 8; *S. costicollis*, 10 : 9; *S. pembertoni*, 16 : 8. The unverted sac extends almost to the apex of the struts in *intrudens* and *fulvitaris*, whereas in the other two species it reaches to about the middle of the struts; but the most striking specific differences are to be found in the very large and complex transfer apparatus at the end of the sac, which are well shown in Mr. Jobling's excellent drawings. The spiculum is of the usual form—a stout rod, with a Y-shaped fork at the attached end, and the free end strongly curved and somewhat spatulate. The eighth ventrite is lightly chitinised, with a hyaline median stripe, and the basal margin is very deeply bisinuate.

In the female genital tube the vaginal palps are of quite normal form and extremely similar in the three species examined (*fulvitaris*, *pembertoni* and *costicollis*), and in the specimen of *fulvitaris* figured (Pl. viii, fig. 5) the palps are 0.1 mm. long and the supporting plates 0.75 mm. In the bursa copulatrix is a more or less complicated chitinous structure, which differs markedly in each species (Pl. viii, figs. 2–4), its

function apparently being to engage with the equally complex transfer apparatus of the male in order to bring the orifice of the ductus ejaculatorius opposite the duct leading to the spermatheca. The characteristic eighth ventrite (Pl. viii, fig. 6) is very similar in the three species, only differing slightly in the form of the angulated free end.

The preparations from which figures 2, 3, 5 and 6 on Plate vii were drawn were kindly lent to me by Mr. F. Muir.

Genus **Neosyagrius**, Lea.

Neosyagrius porosus, sp. nov. (Plate vi, fig. 5).

♂ ♀.—Integument dull black or piceous, unevenly clothed with pale brownish scales of very different sizes.

Head shiny and bare on the vertex and with shallow reticulate punctation; the forehead quite flat, with dense scaling, which conceals the sculpture. *Rostrum* with the dorsal outline almost in the same plane as that of the forehead as far as the antennae, then sloping rather abruptly; the flat portion opaque, very finely shagreened, densely squamose like the forehead and indistinctly tricarinate, with a longitudinal impression on each side just above the sinuous carina that forms the upper margin of the scrobe; the apical area rather more shiny, shallowly punctate, and with a sparse band of very small scales between the apices of the scrobes. *Antennae* with the scape strongly bisinuate in the basal half, the apical half broadly clavate, the outer face grooved for the reception of the funicle, the posterior edge with a sharp carina that does not reach the apex, the anterior face clothed with long, subrecumbent, squamiform setae; the funicle with joints 1 and 2 very long and subequal, 3 as long as broad, the rest becoming progressively shorter and more transverse. *Prothorax* subquadrate, as long as broad, with the sides subparallel in the middle for more than half its length, and narrowing rather more at the apex than at the base, the basal margin broadly rounded; the whole surface covered with deep, coarse, subreticulate punctures, the apical area depressed much below the level of the somewhat tumid disk, which is traversed by a broad, deep, longitudinal furrow that widens at the base; the spaces between the punctures finely shagreened and bearing flattened, subrecumbent, brown setae. *Scutellum* minute, triangular. *Elytra* ovate, broadest near the base and rapidly narrowing behind, narrower in the ♂; the basal margin strongly sinuate, with the external angles projecting forwards, the lateral areas markedly inflexed, and the apex obtusely rounded in the ♀ and almost subtruncate in the ♂; the dorsal outline in the ♀ rising abruptly at the base, then almost flat to the middle, then sloping strongly and becoming almost perpendicular behind, in the ♂ more convex in the basal half and less steep behind; the very shallow striae each containing a row of large spaced punctures (containing no granules), those in stria 7 smaller than those in 8 and 9, and the punctures in row 10 (which is complete) much smaller still; the intervals smooth, without granules or punctures, and here and there connected together by higher transverse septa in the striae, the depression at the base of the suture being very shallow; the unequal curved subrecumbent scales fairly dense at the base from the shoulder to stria 2 and on irregular transverse patches on the disk and declivity, elsewhere on the disk sparse and uneven, the lateral inflexed areas being quite bare. *Legs* stout, the femora strongly clavate, the front pair rather thicker than the others; the squamiform setae elongate, fairly dense and fulvous, subrecumbent on the femora, more raised on the tibiae, and the femora without a pale ring. *Venter* with long, curved, suberect, flattened setae; in the ♂ the first visible ventrite with a very deep median impression containing numerous fine erect setae, its posterior margin bearing two transversely laminate small erect tubercles; the anal ventrite of the ♂ broadly impressed and with large shallow punctures.

Length, 3·3–5 mm. ; *breadth*, 1·6–2 mm.

NEW SOUTH WALES: Dunoon, iv.1921 (*Pemberton*—type); Nimbin, iv.1921 (*Pemberton*).

Described from four specimens.

Very similar to the genotype, *N. cordipennis*, Lea, the only species described up to the present, which differs in the following particulars:—The scales or setae are throughout much shorter, broader and quite recumbent; the prothorax is slightly transverse; the elytra are more distinctly striate, with the intervals more regular and convex, the basal sutural depression is much deeper, every puncture bears a minute granule on each side projecting over the edge, and the posterior declivity is vertical in the ♂; the posterior femora bear a pale patch of scales externally near the apex; on the venter of the ♂ the setae are short and recumbent, the basal ventrite is merely flattened and the anal one is convex and finely rugulose.

***Neosyagrius striatus*, sp. nov.**

♂.—Integument black to piceous, shiny, thinly but fairly evenly clothed with whitish scales and golden-yellow setae.

Elongate-ovate, much narrower than either of the other two species, from which it differs also in its shiny integument and more deeply striate elytra; moreover, the pronotum is less flattened and the sides much less steep. The setae on the prothorax are much narrower than those of *cordipennis*, and even rather finer than those of *porosus*, which are dark brown instead of golden-yellow. The elytra are broadest at about one-fourth from the base, and rapidly narrowed behind, the apex being obtusely rounded; the punctures bear a minute granule on each side; the scales and setae are narrower and more evenly distributed than in the other two species, being entirely recumbent; the scutellar depression is much shallower than in *cordipennis*, and there are no transverse elevations as in *porosus*. The setae on the femora are sparse, narrow and recumbent, and there is no pale ring; in *porosus* they are slightly broader, denser and not quite recumbent, being somewhat curved; whereas in *cordipennis* they are very broad and scale-like, lie quite flat, and form a pale ring near the apex on the posterior pairs. The venter of the ♂ has the disk of the first visible ventrite flattened, very coarsely punctate and shiny, and with the usual two tubercles on the posterior margin; the anal ventrite is slightly convex in the middle and coarsely punctate; the setae are short, sparse, narrow and recumbent.

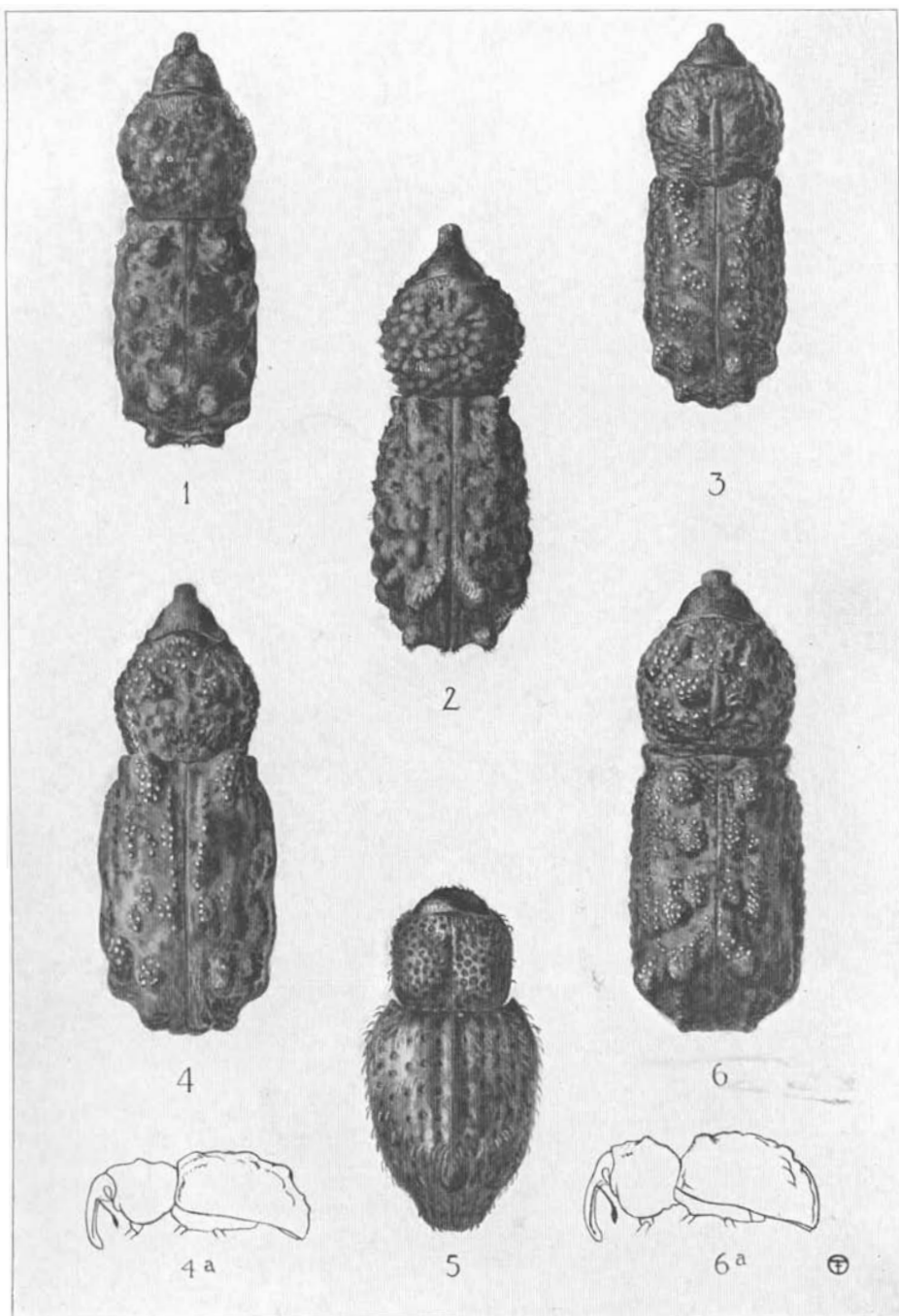
Length, 2·75 mm. ; *breadth*, 1·25 mm.

NEW SOUTH WALES: Nimbin, iv.1921 (*Pemberton*).

Described from a single male.

EXPLANATION OF PLATE VI.

- Fig. 1. *Syagrius fulvitaris*, Pasc.
„ 2. „ *squamipes*, Mshl., sp. n.
„ 3. „ *costicollis*, Mshl., sp. n.
„ 4. „ *pembertoni*, Mshl., sp. n. ; *a*, lateral view.
„ 5. *Neosyagrius porosus*, Mshl., sp. n.
„ 6. *Syagrius intrudens*, Waterh. ; *a*, lateral view.
-

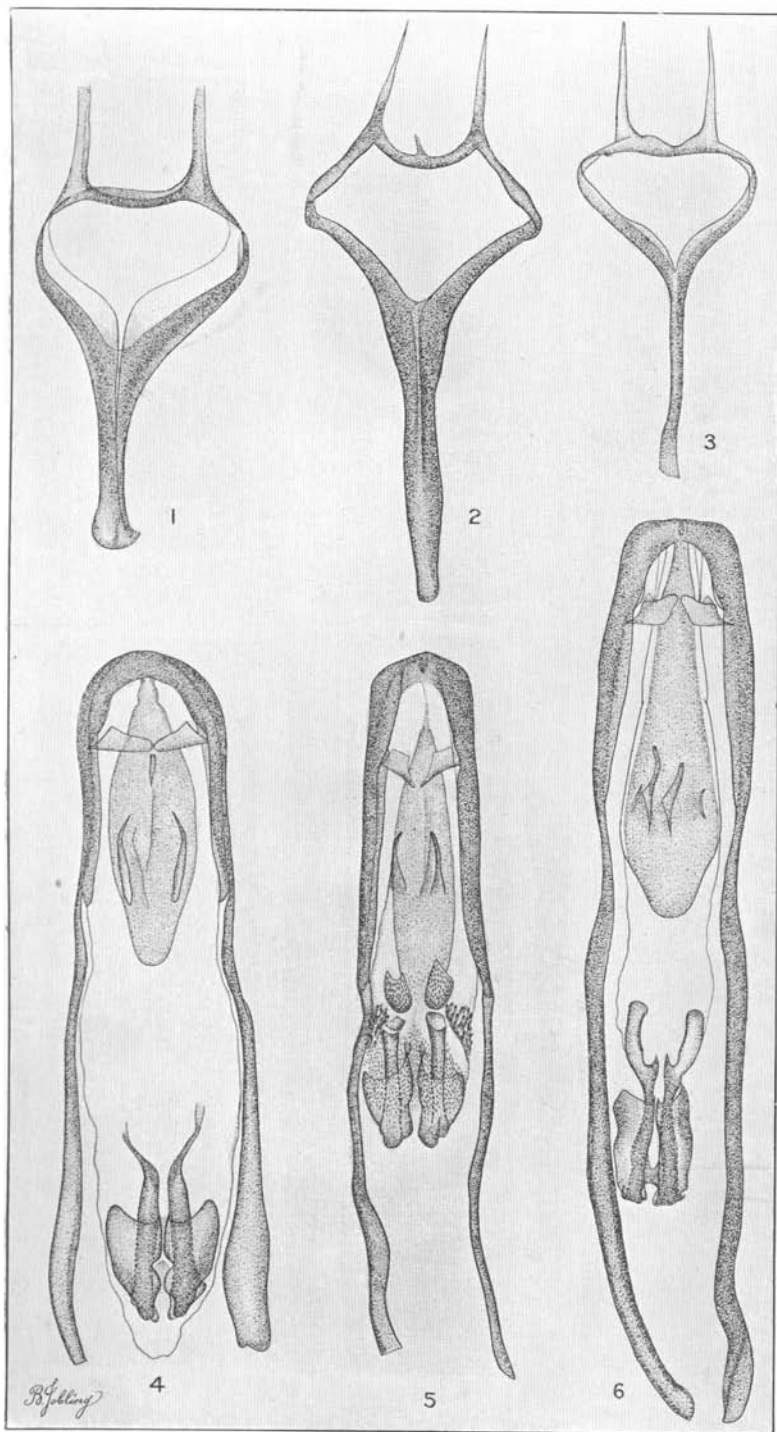


AUSTRALIAN FERN WEEVILS.

EXPLANATION OF PLATE VII.

Male genitalia of *Syagrius*.

- Fig. 1. Tegmen of *S. intrudens*, Waterh.
" 2. " *S. pembertoni*, sp. n.
" 3. " *S. costicollis*, sp. n.
" 4. Aedoeagus of *S. intrudens*, Waterh.
" 5. " *S. costicollis*, sp. n.
" 6. " *S. pembertoni*, sp. n.
-



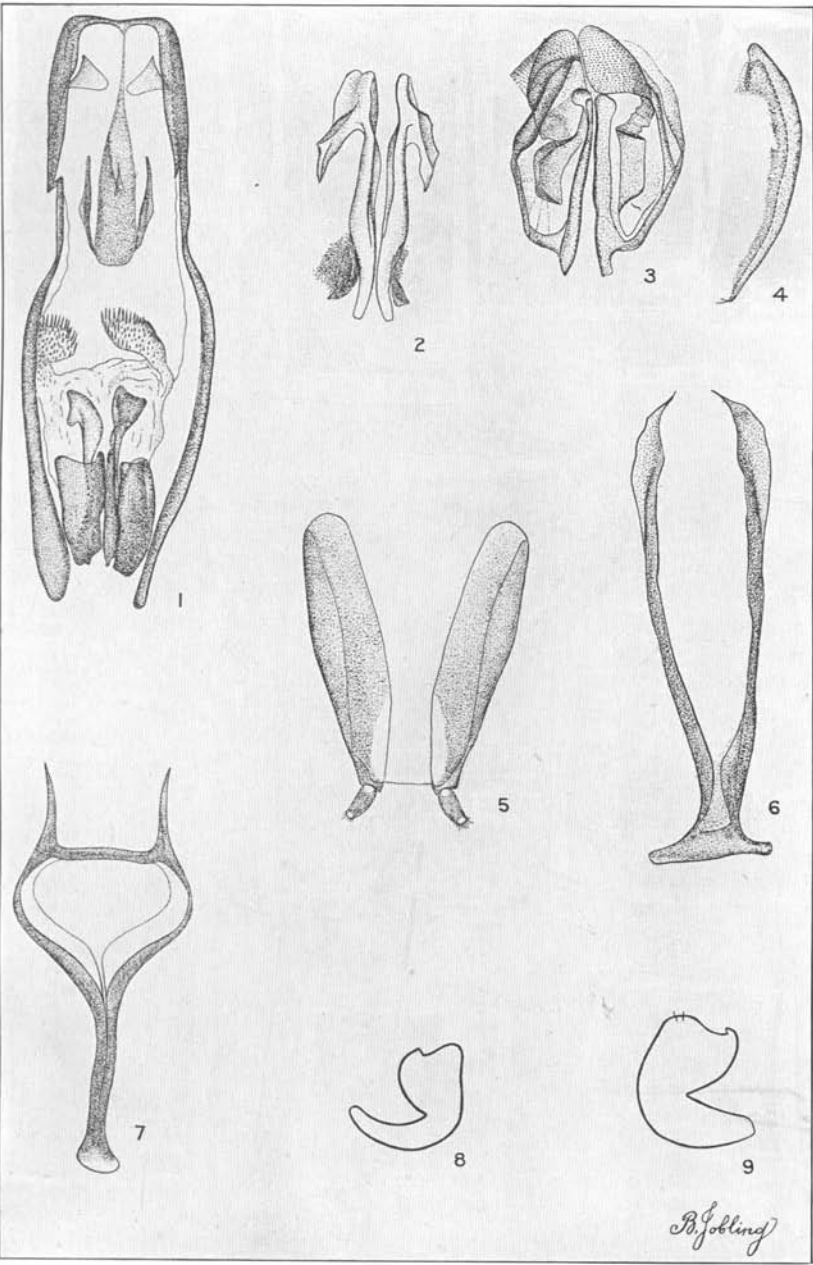
MALE GENITALIA OF AUSTRALIAN FERN WEEVILS.

EXPLANATION OF PLATE VIII.

Male and Female Genitalia of *Syagrius*.

Fig. 1. Male aedoeagus of *S. fulvitarsis*, Pasc.

- | | | | |
|---|----|--|--|
| „ | 2. | Chitinous structure in bursa copulatrix of <i>S. fulvitarsis</i> , Pasc., ♀, ventral view. | |
| „ | 3. | „ „ „ „ „ „ „ <i>S. costicollis</i> , sp. n., ♀, „ „ | |
| „ | 4. | „ „ „ „ „ „ „ <i>S. pembertoni</i> , sp. n., ♀ „ „ | |
| „ | 5. | <i>S. fulvitarsis</i> , vaginal palps of ♀. | |
| „ | 6. | 8th ventrite of ♀. | |
| „ | 7. | tegmen of ♂. | |
| „ | 8. | spermatheca of ♀. | |
| „ | 9. | <i>S. pembertoni</i> , „ „ | |



MALE AND FEMALE GENITALIA OF AUSTRALIAN
FERN WEEVILS.