Rev. Chilena Ent.
2003, 29: 59 - 65

A BALL FORMING WEEVIL FROM YOUNG *NOTHOFAGUS* LEAVES IN CHILE (COLEOPTERA: CURCULIONIDAE: CURCULIONINAE: SPHAERIOPOEINI).

GUILLERMO KUSCHEL

ABSTRACT

A weevil, *Sphaeriopoeus faber*, is described from Chile, which rolls and folds young leaves of *Nothofagus obliqua* (Mirb) Oerst. to tight balls, a way of life previously not known in Curculionidae. The leaves are then nipped off the tree by deep incisions to or severance of the petiole. The balls become part of the forest floor litter till adults emerge from them. The Sphaeriopoeini is proposed as a new tribe in Curculioninae, to be assigned a place next to Molytini, with *Sphaeriopoeus* as new type genus, and *S. faber* as new type species.
Key words: Curculionidae, habits, *Nothofagus,* ball forming weevil.

RESUMEN

Se describe el gorgojo *Sphaeriopoeus faber*, el que enrolla y dobla hojas nuevas de *Nothofagus obliqua* (Mirb) Oerst en bolas apretadas, un hábito no descrito previamente en Curculionidae. Las hojas son entonces cortadas mediante incisiones profundas o daño del pecíolo. Las esferas pasan a formar parte de la hojarasca hasta que los adultos emergen. Se propone Sphaeriopoeini como nueva tribu en Curculioninae, a ser asignada cerca de Molytini, con *Sphaeriopoeus* como nuevo género tipo y *S. faber* como nueva especie tipo.
Palabras Clave: Curculionidae, hábitos, *Nothofagus,* gorgojo enrollador de hojas.

INTRODUCTION

An opportunity is rarely presented to describe a weevil that reveals a spectacularly new way of life. This way of life is unique within the entire family Curculionidae. The weevil can and does fold up the whole leaf of the host to a tight ball without first making any deep incisions to the leaf blade the way Attelabinae and many Rhynchitinae of the family Attelabidae do. Although specimens of the weevil had been collected over one hundred years ago by the French-born Chilean entomologist Philibert Germain as early as 1899, the species remained undescribed to this day. Thanks to the forest pest expert Alexis Villa, who happened to be looking at the leaf litter under *Nothofagus obliqua,* the presence of an incredibly large number of perfectly formed balls was noticed under this tree known in Chile as roble. Good samples of balls were taken and sent to the Laboratorio de Entomología Forestal, Universidad Austral de Chile where some were preserved, others opened and the remainder kept for rearing through. Four adults were obtained and the agent of the strange balls was revealed and is described below.

7 Tropicana Drive, Mt Roskill Auckland, New Zealand. E-mail: gkuschel@xtra.co.nz

(Recibido: 5 de septiembre del 2002. Aceptado: 26 de noviembre del 2002).

Sphaeriopoeus n. gen. Figs 1-20

(type species *Sphaeriopoeus faber* n. sp.; gender masculine)

Diagnosis.

A *Nothofagus* canopy weevil with appressed pubescence and erect sensory hairs on dorsal surface, and frayed scales on sterna; with a rudimentary proventriculus and a rectal ring; with a tucked-under rostrum, deeply grooved scrobes, geniculate antennae and lateral, coarse eyes; with toothed femora, uncinate tibiae, ascending tibial combs and thin, connate claws; sclerolepidia and stridulatory files absent; labial palpi contiguous, 3-segmented; sternite 9 in male moderately asymmetric, left prong rather slender, with a narrow lobe; tegmen complete with parameres; sternite 8 in female with heavily pigmented, strongly

divaricating arms; hemisternites traceable but unpigmented, without styli. Adults folding leaves to tight balls and cutting petioles for balls to drop to the ground; larvae and pupae staying in balls to full development.

Description

Head not retractile to eyes, not constricted. Frons distinctly narrower than rostrum, with a small median fovea or groove. Eyes large, oval, slightly protruding from head capsule, in lateral view equally distant from dorsal and ventral surfaces of head, with coarse, convex ommatidia, without interfacettal setae. Rostrum robust, moderately curved, postrostral and frontal hairs and setae directed backwards. Epistome small, truncate or weakly emarginate, with a slight medioapical impression, with one short seta on either side. Scrobes deeply sulcate, directed to gular angle below eyes, broadly visible from above, lower edge abruptly abbreviated ending in a blunt tooth or knob. Antennae antemedian, scape extending to front margin of eyes; funicle 7-segmented, slender, antennite 1 of funicle much more robust and longer than 2, others moniliform; club elongate, tightly segmented, pointed. Mandibles (Fig. 19) robust, short, with three interlocking teeth and one strong dorsal seta, area between proximal tooth and base of mandible a broad sinus; outer margin also with a broad sinus; adductor's tendon much broader than abductor's; epipharyngeal process as long as mandible. Maxillae with a long seta on stipes and first palpal segment, with two long setae on palpiger; galea/lacinia sector with numerous fine setae, with about 8 peg-like setae; palpi 3-segmented, terminal segment with 15 or more papillae in a large, shallow cup at apex. Prementum as long as wide, slightly widening apicad, lacking setae, with contiguous, 3-segmented palpi, basal segment relatively large and broad, 3x longer than 2, terminal segment small, blunt, with four papillae at apex.

Prothorax transverse, strongly sinuous at base, with a median emarginate lobe pressing against scutellum, without a raised margin at base, widest at base, strongly converging apicad with gentle curvature to a narrow collar; ocular lobes absent. Scutellum distinct, level with elytra, falling vertically at base.

Elytra short and wide, strongly convex in profile, strongly sinuous at base; basal declivity vertical at first, distinctly proclinate (undermined) towards sides, with humeral callus, with fine striae, first six striae reaching base, striae 9 and 10 running parallel as far as side of apical declivity where more or less merging into one, margin beside merged striae somewhat explanate and thin. Inferolateral flange short, extending only to middle of elytral length, explanate area distinctly marked by a subcarinate line. Stridulatory organ absent.

Wing (Fig. 9) elongate, 2.2x as long as elytra, 3.2x longer than wide, membrane clear, apical field twice as long as basal field, these fields distinctly separated by a nick or pinch at stigmatical area, two anal veins present, anal lobe and mediocubital cell absent, radial and radiomedial sclerotisations strongly pigmented, stigmatical area and basal third of *C* with a few setae, hind margin with short cilia.

Fore coxae median in position, narrowly separate, with a distinct anterior tooth; middle coxae widely disjunct, as far apart as apical width of rostrum, mesosternal process broad, obliquely descending; mesepisternum much larger than mesepimeron, these two pleurites separated by a distinct subsulcate suture.; metasternum between middle and hind coxae short, distinctly less than a mid-coxal diameter; metepisternum broad, metepisternal suture lacking sclerolepidia. Ventrite 1 a little longer than 2, suture between these deep, complete; ventrite 3 shorter than 2, ventrite 4 as long as 3, ventrite 5 flat, apically rounded in male, sharply pointed in female, with a cluster of short setae by the apical tooth in latter.

Femora pedunculate, incrassate part with a tooth each, teeth decreasing in size caudad; tibiae dorsally carinate, strongly uncinate, with ascending combs, in male slender, curved, with a very small premucro on fore tibiae, in female robust, subsinuous, with long premucro on front and middle tibiae, with a short one on hind tibiae. Tarsites 1 and 2 slender, loosely padded underneath, tarsite 3 much wider than 2, bilobed, densely padded; claw segment long, passing a good deal lobes of tarsite 3, passing only slightly ventral pad, slightly compress, nearly parallel-sided in dorsal view; claws extremely slender, weakly divergent, connate at base.

Proventriculus placed at anterior part of prothorax, soft and membranous, subcylindrical, a little longer than wide, only anterior half of internal wall studded with eight diverging double rows of

soft hairy vestiture, external surface in cross section not distinctly octagonous. Rectal valve with a well pigmented ring.

Tergite 1 membranous, others heavily pigmented, 2-6 broadly divided along midline, hemitergites only slightly broader than median membranous stripe, 4-6 rather sharply angled posteromedially; spiracular area without pigmentation; tergite 7 with small pruinose patch on sides, with even smaller pruinose patches on tergites 5 and 6. Ventrite 5 of female (Fig. 20) sharply pointed at apex, with a cluster of short setae nearby. For remainder of internal features see under the description of the species below.

Terminalia and genitalia at description of species below.

Chile, Valdivian rainforest from latitude 35 to 41°S.

Hostplant. *Nothofagus* (Fagaceae).

Remarks. *Sphaeriopoeus* is strikingly different from anything known to me from Chile and elsewhere. The unusual features of the genus are probably the result of adaptation to folding new leaves of deciduous *Nothofagus* species to tight balls without making incisions on the leaf blade the way attelabids do. The function of the large infrarostral process of males is unknown. The process may suggest a participation of the male in forming the balls.

Etymology. Sphæriopoeus ('ball-maker') is derived from the Greek diminutive sphærion = little ball, and poieo = to make, for rolling up balls as food for larvae.

Sphaeriopoeus faber n.sp. **Figs 1-20**

Habitus as in Figs 1, 2. Black, tarsi reddish brown. Vestiture appressed, uniform, ash-grey in general appearance but consisting of fine to subsquamiform white hairs and straight erect setae; sterna with broad frayed white (aquifugous) scales.

Head (Figs 3, 4) slightly diverging caudad, finely, shallowly punctate; frons in male 0.38 the maximum rostral breath, 0.5 the width of rostrum at apex, in female 0.60 the width of rostrum, with small fovea or short groove in line with hind margins of eyes, more finely punctate than head capsule. Rostrum in male 0.77 the length of prothorax, 2.3x as long as wide, postrostrum 0.56 rostral length, in profile straight to near middle with frons, then distinctly curved apicad, much more strongly curved ventrally owing to presence of a large tooth-like process, dorsal punctation dense, coarser than on frons, underside with a very robust and prominent process, this with a basis extending from behind postmentum to a little caudad of antennal insertions, area between process and jowl-like sides of rostrum below scrobes more or less excavated for reception of fore coxae; process in ventral view at least as broad as prementum and diverging apicad, broadly emarginated between blunt lateral angles, with a pair of long setae near apex and a variable number of other setae; hind side of process concavely curved, appressed in repose against coxae, hooking these behind. Rostrum in female 0.70 the length of prothorax, twice as long as wide at apex, a little swollen on underside below antennal insertions, otherwise roughly as in male.

Prothorax 1.35 - 1.50x wider than long, sides strongly converging in gentle arc towards a narrow apical collar, basal angles obtusely rounded, disc longitudinally and transversely convex, densely punctate on shiny integument, intervals between puncta not wider than subsquamiform hairs in northern populations of the species, vestiture at basal quarter largely transverse , most of remainder directed obliquely backwards towards midline. Scutellum as wide as long, rounded posteriorly.

Elytra 1.21 – 1.27x wider than prothorax, relatively short, only 1.23 – 1.27x longer than their combined width; striae much narrower than interstriae, well marked, distinctly wider and deeper on declivity and sides; interstriae finely asperopunctate, lateroapical explanate area with some conspicuous longer transverse hairs.

Male. Sternite 8 (Fig. 10) with strongly transverse plates and an unpigmented apodeme. Sternite 9 (Fig. 11) somewhat asymmetrical, left arm with a narrow lobe. Tegmen (Fig. 12) with a short upcurved apodeme, a strong, well pigmented ring and rather long, weakly pigmented, non-setose parameres. Aedeagus (Figs 13, 14) not projecting into metathoracic lumen, not quite as long as abdomen measured from behind hind coxae, not tilted to the right, aedeagal body distinctly longer than apodemes, rather weakly sclerotised, with short ventral carina at apex, inflected at base at insertion of apodemes, with broadly unpigmented tectum, with a pair of pointed valves (remnants of tectum)

over ostium; apex acute, weakly apiculate with shallowly concave-sided margins, with a few setae at apex; internal sac extending to middle or a little beyond middle of apodemes, with very fine wall vestiture, without sclerites.

Female. Sternite 8 (Fig. 15) with strongly divaricating arms, these heavily pigmented as far as lateral angles, a small lateral area weakly pigmented, remainder submembranous but with well marked posterior margin and a few long marginal setae on either side of midline. Genitalia (Fig. 16-18) bulky, hemisternite (Fig. 17) firmish but unpigmented, without styli but with three long, stiff setae at apex; bursa fully distended to a broad and deep, ventrally depressed bag; spermatheca bulky, distinctly pigmented, unsculptured, with a rather long and subcylindrical gland, spermathecal duct longer than bursa, inserted ventrally at base on bursa and directly onto base of spermatheca near gland.

Length 1.7 – 3.0 mm; width 1.1 – 2.1 mm.

CHILE. Curicó: El Coigo on the Andes, 1 m, 1 *f*, Dec 1959, L E Peña. **Talca**: El Radal, 1000 m, 1 f, 30 Nov 1957, L E Peña. **Linares**: Cordillera Parral, Fdo Malcho, 650 m, 3 m *m*, 3 f *f*, Nov 1956, L E Peña; Reserva Nacional Los Bellotos del Melado, Quebrada Hornillos, 800-900 m, 3 m *m*, 1 f, Jan 2000, A Villa. **Ñuble**: Cord. Chillán, Las Cabras, 1300 m, 1 m, 1 f , 23 Dic 1954, L E Peña; Termas de Chillán, 10 m *m*, 9 f *f*, 1899, Ph Germain. **Concepción**: Fdo Andalién, 3 f *f*, 20 Sep 1957, Artigas. **Arauco**: Cordillera Nahuelbuta, Pichinahuel, 1 f, Jan 1959, G Barría; Cord. Nahuelbuta, 2 m *m*, 2 f *f*, 1983, H Franz; Contulmo, 1 m, 17 Sep 1945, G Kuschel. **Cautín**: Temuco, 1 m, 15 Oct 1983, on *Nothofagus obliqua*, G Kuschel. **Valdivia**: Ñapeco, 1 m, 13 Jan 1945, on *N. obliqua,* G Kuschel; Valdivia on road to Cayumapu, 2 m *m*, 3 f *f*, 25 Oct 1965, Balogh; La Unión, 1 m, 26 Oct 1965, Balogh. 51 specimens in all.

Types. Holotype male, 2.7 x 1.65 mm, Quebrada Hornillos in Reserva Nacional Los Bellotos de Melado, Museo Nacional de Historia Natural, Santiago; paratypes in the same Museo, in Departamento Forestal, Universidad Austral, Valdivia and New Zealand Arthropod Collection .

Hostplant. *Nothofagua. obliqua*, larva developing in young leaves folded up to balls by the adult.

Biology. *Sphaeriopoeus faber* has a life habit unlike that of any other curculionoid known to me. Adults prepare a ball by folding at first just the tip of the leaf lamina to the underside and rolling it, then tightly folding the sides over the rolled apex, then rolling and folding the leaf again, repeating this procedure once more to get as far as the petiole, gluing all the folds during the procedure together. The diameter of the balls fluctuates between 5.0 and 7.5 mm, averaging about 6.2 mm. An egg is found inside the first rolled bit of the leaf. As there are no signs of oviposition holes on ready made balls, it is assumed that eggs are laid on the underside of the leaves before these are rolled and folded. An unfolded, 36 mm long leaf is shown in Fig. 7. Balls were collected at the Quebrada Hornillos by Alexis Villa and sent to the Facultad de Ciencias Forestales, Universidad Austral, Valdivia. Cecilia Ruiz, the staff member involved with the rearing, took notes about the weevil and passed them on.

The notes generously volunteered by Cecilia Ruiz are, somewhat freely translated, as follows: "The host of *Sphaeriopoeus faber* is *Nothofagus obliqua* (Mirb.) Oerst. var. *obliqua,* a tree occurring from VI Región to X Región [latitudes 35° to 41∞S]. The weevil seems to concentrate its activity on just some trees of the population. Large numbers of balls were lying on the ground underneath the trees. Samples were collected on two occasions, on 18 October 1998 and 12 October 2000. *N. obliqua* is a deciduous species, its leafbuds bursting from the second half of September to the middle of October. The weevil forms the balls whilst the leaves are still fresh and tender and once finished the task appears to incise deeply or sever the petiole [presumably to prevent further growth that might spoil the ball]. All the balls found on the ground were green and remained green for a good while whilst being attended to at the lab. Every ball examined had one egg only. Larvae hatched in the first half of November. They were feeding on the balls till middle of December remaining in the balls for pupation. The walls of the balls were paper-thin at the end of feeding. Adults emerged in January. The temperature of the lab fluctuated between 20 and 24°C.

The genus *Nothofagus* es known in the English

literature as southern beech being the main component by far of the Chilean rainforest. Its distribution extends over 2550 km from near Valparaíso to Cape Horn, from latitude 33 to 56°S. It consists of ten distinct species, seven of them deciduous, three evergreen. The weevil has so far been observed only on *N. obliqua*. Weevils occurring on *Nothofagus* are usually found on several species of the genus, rarely on just one. Whether this might be the case also for *Sphaeriopoeus* remains to be seen.

Relationship of *Sphaeriopoeus*.

No matter which higher classification of Curculionidae of the main authors (Thompson, 1992; Kuschel, 1995; Marvaldi and Morrone, 1999; Anderson, 2002) is followed, *Sphaeriopoeus* would defy a safe placement at tribal level. By following Kuschel's system the genus belongs in Curculioninae, a subfamily that according to his scheme includes two dozen traditional subfamilies, all demoted to tribes. Because of the presence of uncinate tibiae, divergent, non-divaricate claws, normal, non-ascending mesopleurites, uneven width of sutural flanges, unexposed pygidium, uneven arms of sternite 9 in male, and distinct parameres, *Sphaeridiopoeus* would appear to be closest to Molytini. The combined features listed in the diagnosis of the genus above aply also to define **Sphaeriopoeini new tribe** (type genus *Sphaeriopoeus* Kuschel) which is to be assigned a place next to Molytini.

ACKNOWLEDGMENTS

I wish to thank Dolly Lanfranco and Cecilia Ruiz, Laboratorio de Entomología Forestal, Universidad Austral de Chile, Valdivia for the interest they took in those little leaf bolds found in leaf litter to ascertain who the agent of them was. I am grateful to Trevor Crosby, Landcare Research, for facilities provided at the Mt Albert Research Centre. Thanks are due also to Birgit Rhode, Landcare Research, for the automontage illustrations included in the paper and her assistance at the SEM equipment for me to see fine details of mouthparts and tarsi.

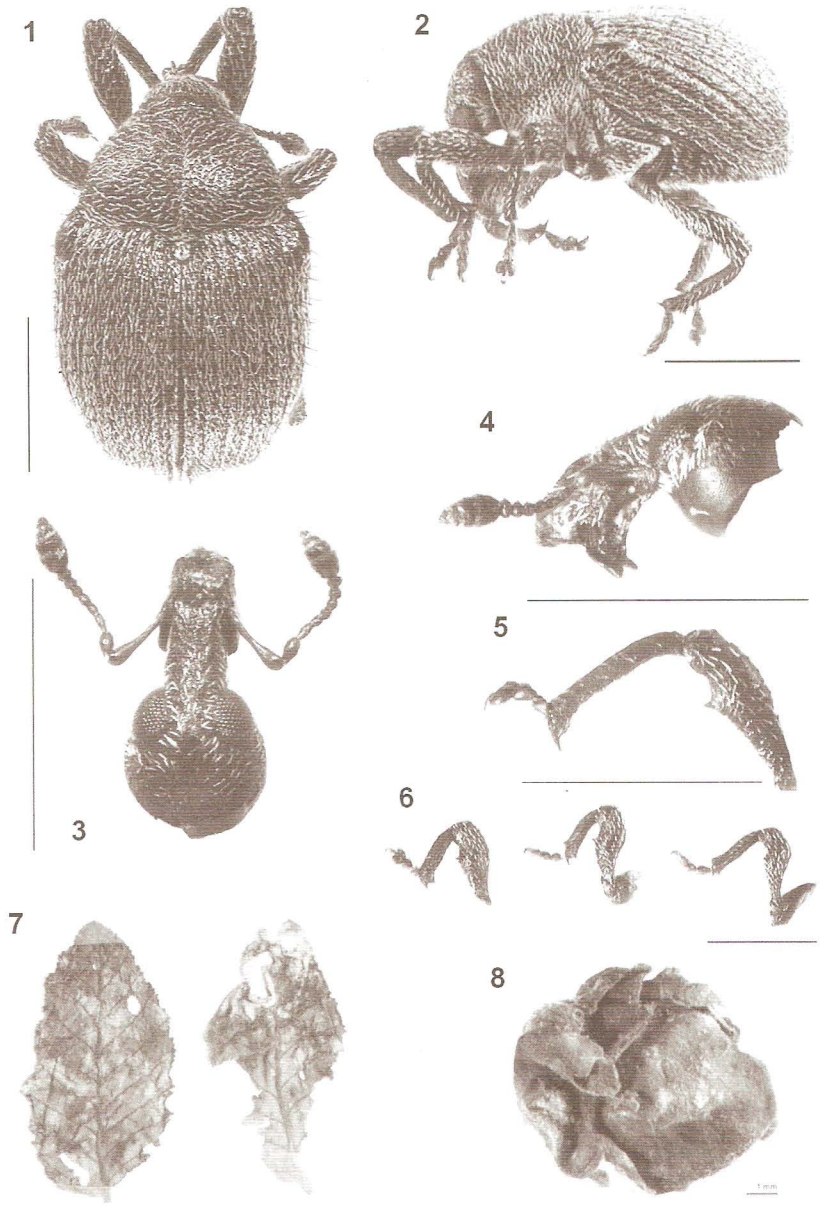
REFERENCES

Anderson, R. S. 2002. Curculionidae. *American beetles, CRC Press, 2: 722-815.*

Kuschel, G. 1995. A phylogenetic classification of Curculionoidea to families and subfamilies. Memoires of the Entomological Society of Washington *14:* 5-33.

Marvaldi, A. E. & J. J. Morrone. 2000. Phylogenetic systematics of weevils (Coleoptera: Curculionoidea): a reappraisal based on latval and adult morphology. Insect Systematics and Evolution *31:* 43-58.

Thompson, R. T. 1992. Observations on the morphology and classification of weevils (Coleoptera, Curculionoidea) with a key to major groups. Journal of Natural History *26:* 835-891.



Figuras 1-8. *Sphaeriopoeus faber* Kuschel n.gen. n.sp., Chile, Prov. Linares, Quebrada Hornillos, Reserva Nacional Los Bellotos del Melado: 1. holotype male, dorsal; 2. same, lateral; 3. male head, dorsal; 4. male head, lateral; 5.male fore tibia; 6. female fore, middle and hind legs from left to right; 7. two unfolded leaves of the host *Nothofagus obliqua* hardly touched at left, largely consumed at right; 8. a leaf rolled and folded up to a 7 mm wide ball.

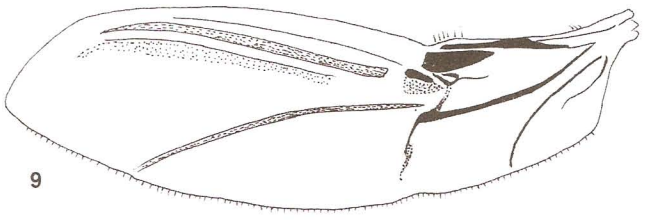
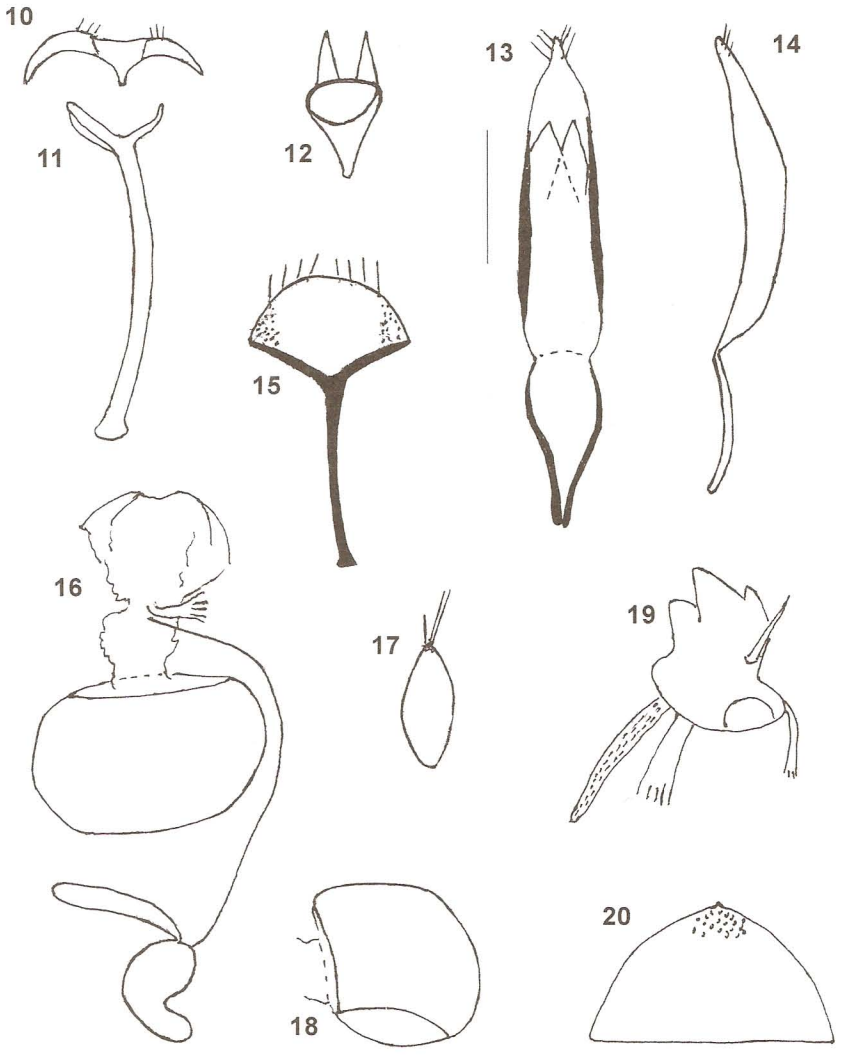


Figura 9. *Sphaeriopoeus faber*: hind wing (actual size of wing 4.0 x 1.25 mm).



Figuras 10-20. *Sphaeriopoeus faber*, Male: 10. sternite 8, ventral; 11. sternite 9, ventral; 12. tegmen, dorsal; 13. aedeagus, dorsal; 14. aedeagus, lateral. Female: 15. sternite 8, ventral; 16. genitalia, ventral; 17. hemisternite, lateral; 18. bursa, lateral; 19. right mandible, dorsal; 20. ventrite 5, ventral.
(Scale representing 0.5 mm for Figs 10-18, 20, and 0.25 for Fig. 19.)