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TWO NEW SPECIES OF GALL-FORMING
SPHENOPTERA SOLIER (COLEOPTERA: BUPRESTIDAE)
FROM SOUTH AFRICA

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ABSTRACT

Two new species of gall-forming buprestids, *Sphenoptera (Tropeopeltis) gnidiaphaga* Bellamy and *S. (T.) loranthiphaga* Bellamy, are described from South Africa. These are the first gall-forming buprestids to be recorded from Africa. Adult and larval stages are described and the adults are illustrated for both species. The formation of galls by buprestids is discussed.

Gall formation in plants induced by the activity of buprestid larvae is a rarely recorded phenomenon. The few published records do show, however, that due to its occurrence in widely separated taxa (both in the taxonomic and distributional sense), it has apparently evolved independently a number of times. The overall lack of knowledge concerning buprestid larva and their interaction with host plant species will hopefully, in time, be corrected and will undoubtedly show that many more species of Buprestidae are involved in gall formation.

The abbreviations used for the lending institutions and type repositories are traditional ones used for South Africa or are based upon the system of Arnett and Samuelson (1969), with the following not found in that work: BMNH—British Museum (Natural History), London, U.K.; CLBC—C. L. Bellamy collection; MNHN—Museum National d’Histoire Naturelle, Paris, France; NCI—National Collection of Insects, Pretoria, R.S.A.; NMP—National Museum, Prague, Czechoslovakia; TM—Transvaal Museum, Pretoria, R.S.A.; and GAWC—G. A. Williams collection, Lansdowne, N.S.W., Australia.

DISCUSSION

There are very few published records of gall-forming buprestids and, as far as could be ascertained, none from Africa. Knull (1920) listed *Eupristocerus cogitans* Weber (subfamily Agrilinae) as forming galls on two species of alder, *Alnus rugosa* and *A. incana*. Both Fisher (1928) and Felt (1940) recorded several species of the large genus *Agrilus* Curtis as gall-formers in North America: (1) *A. politus* (Say) causes “globose constricted twig swellings” on willow, *Salix* sp., with the subspecies *pseudocoryli* Fisher recorded from a gall of the same description on hazelnut, *Corylus*, by Felt and reared from galls on *C.*

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rostrata and *C. americana* by Fisher; (2) *A. anxius* Gory is listed as causing "irregular twig and branch annulations" and *A. crataegi* Frost (as *A. politus*) is listed from "globose twig swellings" on *Crataegus* by Felt; and (3) *A. aurichalceus rubicola* Abeille (as *A. viridis* L.) is listed as causing an "irregular stem gall" by Felt and Fisher listed this species as making galls or abnormal swellings on seven species of cultivated and one species of wild *Rosa*. Fisher records *A. ruficollis* (F.) as causing elongate swellings or galls on the canes of blackberry, raspberry and dewberry, *Rubus* spp. Frost (1912) records *A. champlaini* Frost as reared from galls of hornbeam, *Ostrya virginica*, in Connecticut. Nelson (1965) records *Poecilnota bridwelli* Van Dyke (Buprestinae) as reared ex gall-like swelling on limbs of *Populus fremontii* Wats. in California.

In Australia, two species of the genus *Ethon* (Agrilinae) are gall-formers as recorded by Froggatt (1892): *E. affine* Laporte & Gory on the stems of *Pultenaea stipularis* Sm. (Fabaceae) and *E. corpulentum* Boheman on roots of *Dillwynia retorta* (Wendl.) Druce (as *D. ericifolia* Sm.) (Fabaceae) (Hawkeswood and Peterson 1982).

Within the large genus *Sphenoptera* Solier, the gall-forming habit exists in several subgenera. S. Bílý remarks (*in litt.*) about having collected *S. (Chrysolemma) bifulgida* Reitter from root galls of *Salsola* sp. in central Asia. R. L. Westcott comments (*in litt.*) that *S. (Chilostetha) jugoslavica* Obenberger is an apparent gall-forming species and has been introduced into the Pacific Northwest (United States) to control diffuse knapweed, *Centaurea diffusa* Lam. The two new species described herein represent the first records of gall formation in the subgenus *Tropeopeltis*. There does not appear to be any phylogenetic significance in the gall-forming habit in *Sphenoptera* and most likely, in view of its evolutionary success and adaptability (1,100+ species—Obenberger 1930), the gall-forming habit has arisen independently several times.

The genus *Sphenoptera* is widely distributed throughout the Old World with the exception of the Australasian Region. It is currently divided into 15 subgenera, with seven of these occurring in the Ethiopian Region. The large subgenus *S. (Tropeopeltis)* has ca. 196 species described from the sub-Saharan Africa. The last large-scale considerations of *Tropeopeltis* were by Kerremans (1914) and Obenberger (1926, 1927).

There is little literature dealing with the larvae of the Buprestidae. Part of the problem involves matching adults to their larvae when more than one species is found to attack the same host. We were fortunate to find pre-emergent adults together with mature larvae in the one case and no other buprestid larvae involved in the other.

Bílý (1982) outlined four morpho-ecological types of buprestid larvae. The larvae of *Sphenoptera* belong to the first and largest group. These "typical" buprestid larvae have the prothorax very enlarged and dorsoventrally flattened, with the meso- and metathorax somewhat narrower and very short. The 10-segmented abdomen is cylindrical, with the apical (anal) segment being smooth and without any projections. The spiracles are of the multiporous type and are situated on the mesothorax and on abdominal segments 2–10. The head is partially sclerotized and virtually hidden in the prothorax, with the mouthparts free. More specifically, larvae of *Sphenoptera* are usually characterized by an inverted Y-shaped groove on the broad prothorax, a single medial groove on the prosternum and they have 3-segmented antennae. The pupae are exarate. Recent and more detailed works dealing with the larvae of *Sphenoptera* are by Schaefer (1949) and Alekseev (1981).

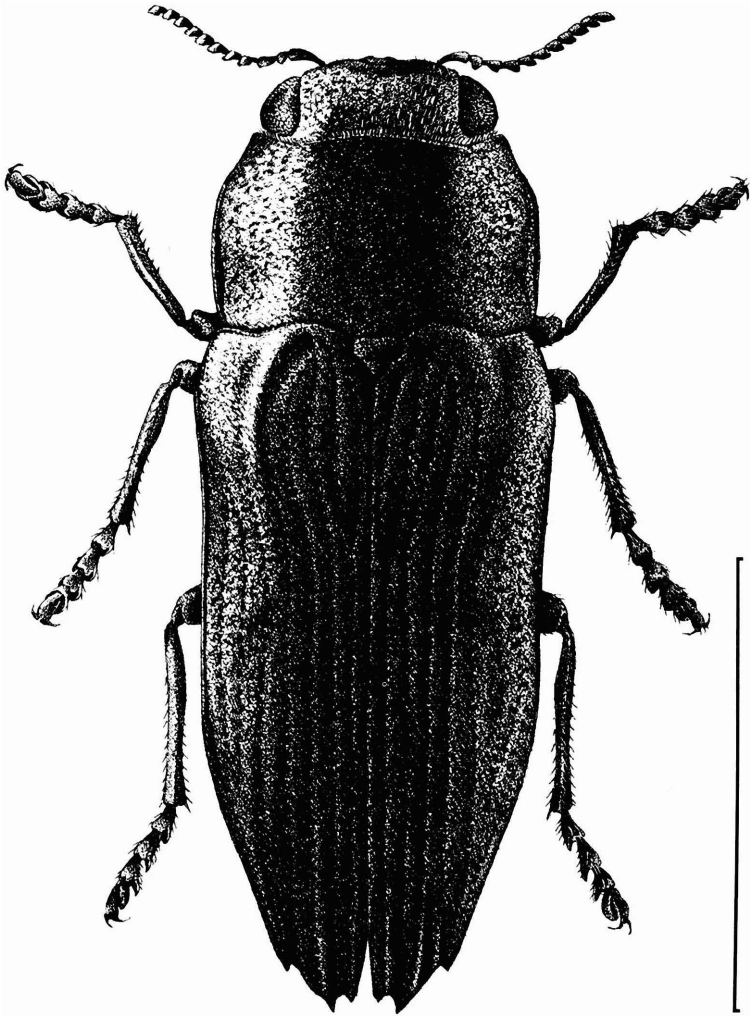


Fig. 1. *Sphenoptera (Tropeopeltis) gnidiaphaga*, holotype (line = 5 mm).

Sphenoptera (Tropeopeltis) gnidiaphaga Bellamy, **sp. nov.**

Figs. 1, 2

Size small, 8.5–12.6 × 2.7–4.3 mm; elongate; flattened above; dorsal color black with faint cupreous reflection; ventral color cupreous; when fresh, covered with whitish pulverulence.

MALE. Head: Surface moderately, shallowly punctate, sparsely clothed with fine recurved setae; vertex flattened; frons slightly depressed medially anterior to supra-antennal carinae, carinae feebly elevated, oblique, joining emarginate frontoclypeus medially; with arcuate groove separating frons from clypeus; clypeus finely, transversely, arcuately striate; clypeus distally concave; labrum with width subequal to length, distally emarginate;

mandibles laterally robust, cupreous, coarsely punctate; eyes large, inner margins slightly diverging dorsally; antennal insertions widely separated; antenna with segment 3 about $2 \times$ length of 2; 4 slightly longer than 3, broader distally, subserrate; 5–11 subquadrate; outer surface sparsely clothed with recumbent setae; inner surface with finely punctate sensory pores. *Pronotum*: $1.5 \times$ wider than long; trapezoidal, slightly wider before middle; anterior margin sinuate, slightly convex medially with rounded marginal carina entire; basal margin trisinate; lateral margin bisinate with lateromedial depression between disc and margin; lateral carinae extending from base to just before apex; disc flatly convex; surface rugose with sparse, very short recurved setae; scutellum transverse, slightly declivous anteriorly, acuminate posteriorly. *Elytra*: Slightly wider than pronotum, widest opposite humeri; sides subparallel to apical $\frac{1}{3}$, then narrowing more abruptly to trispinose apices; medial spine longer and extending further posteriorly than lateral or sutural spines; disc flattened, with feebly elevated costae between elongately punctate striae; costal surface moderately, shallowly punctate, clothed with very short setae; sutural carinae evident apically, prolonged into sutural spines; medioapical costae narrowed, slightly more elevated, prolonged to medial spine; lateral carina most strongly elevated basally, becoming confluent with latero-apical portion of each elytron; epipleural fold broad below lateral carina, in basal $\frac{1}{3}$. *Ventral surface*: Prosternum with process premarginally grooved on either side of middle; apically rounded; latero-apically with lobes extending slightly posteriorly to prominent, globose procoxae; disc sparsely punctate, laterally with larger punctures; proepisternum with crescent-shaped excavation; suture between abdominal sternites 1 and 2 feebly indicated; suture between 2 and 3 evenly transverse; sutures between 3, 4 and 5 slightly anteriorly emarginate; sternite 5 with short longitudinal punctures; laterobasal portion of sternites impunctate, glabrous; apex roundly truncate. *Legs*: Pro- and mesofemora anteroposteriorly compressed, fusiform; metafemora with dorsoventral surfaces subparallel; protibiae slightly arcuate; surface moderately covered with both semierect and recumbent setae; tarsal segment 1 longer than 2; 2 longer than 3; 4 shortest; 5 subequal to 2; 3 and 4 slightly lobed laterally; segments 1–4 with pulvilli; pulvillus on 4 distally lobed; claws widely separated, slightly swollen basally. *Genitalia* as in Figure 2.

FEMALE. Differs from male by being slightly more robust and with sternite 5 more rounded apically.

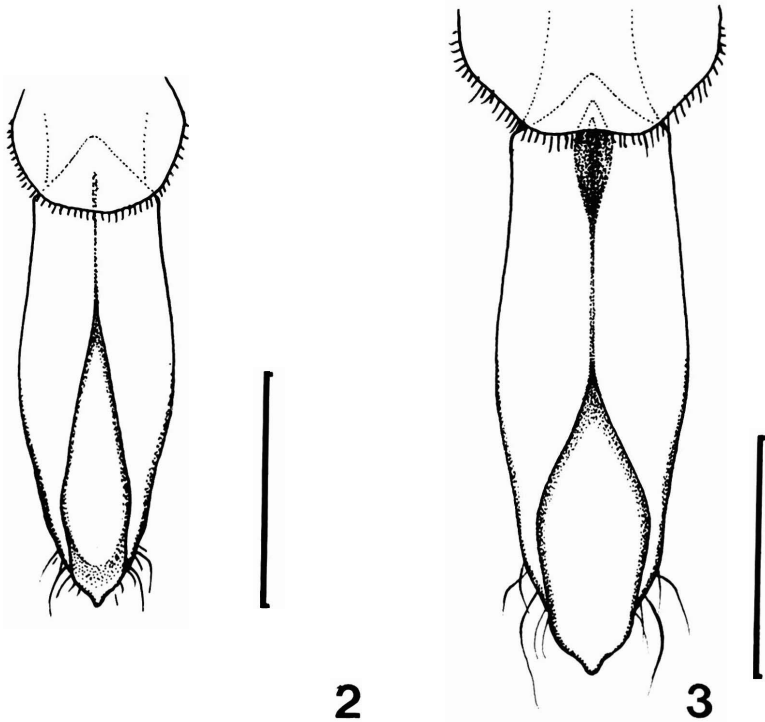
LARVA. Third instar 20–25 mm long; prepupal larvae with abdominal segments shorter and broader: 18–20 mm long; labrum coriaceous, longer than wide, widest distally, margined with dense, short setae and with two prelateral sclerotized rods; mandibles narrowed distally, apically bidentate.

MATERIAL EXAMINED. Holotype δ (TM): SOUTH AFRICA: Natal, Giants Castle Reserve, 1,600 m, S29.16 E29.31, 8–11.X.1983, C. L. Bellamy & C. H. Scholtz, collected from stem of *Gnidia burchelli* (Meisn.) Gilg.; 9 $\delta\delta$, 11 ♀♀ paratypes: same data as holotype except some specimens cut ex. stem galls of *G. burchelli*. Paratypes deposited in BMNH, CLBC, GAWC, GHNC, MNHN, NCI, NMP, RLWE and TM.

ETYMOLOGY. The name is a combination from the host plant genus *Gnidia* and the suffix from the Greek root *phag*, meaning “to eat.”

REMARKS. *Sphenoptera* (*T.*) *gnidiaphaga* seems to come closest to *S.* (*T.*) *sinuosa* Laporte & Gory, but differs in having the pronotum laterally arcuate, elytra without costae or striae and a rounded medial apical spine, and also in the proportions of the antennal segments and structure of the male genitalia.

BIOLOGY. *Sphenoptera* (*T.*) *gnidiaphaga* was found to induce galls on the stems of *Gnidia burchelli* (Meisn.) Gilg. (Thymalaeaceae) in Natal. This plant is a small woody perennial which is widespread in southern Africa. It forms part of the floristic community termed “boulder bed scrub” which, as the name implies, occurs along the rocky stream beds in the lower reaches of the montane habitat in the Natal Drakensberg.



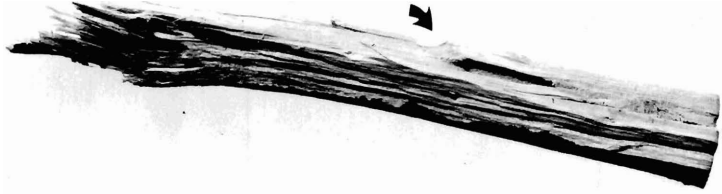
Figs. 2, 3. Male genitalia of *Sphenoptera (Tropeopeltis)* spp. (line = 1 mm). 2, *S. (T.) gnidiaphaga*. 3, *S. (T.) loranthiphaga*.

The adult buprestids emerge from the galls in spring (September, October) and appear to be active throughout much of the summer, during which oviposition occurs sporadically. Females lay eggs in fissures in the bark of young stems at or just below ground level. It is not clear whether females lay a number of eggs or more than one female lays eggs on the stem, but the result is that more than one larva contributes to gall formation (*i.e.*, galls are polythalamous) (see number of emergence holes—Fig. 6).

Asynchronous development of larvae in different galls results from eggs laid at different times during the summer. Larvae that emerge from eggs laid in spring mature and pupate in early winter (June), whereas those that result from eggs laid later on in the season mature and pupate throughout the winter and into spring. All pupae begin to sclerotize only shortly before the adults emerge.

The galls, which grossly enlarge the stem, develop partially above and partially below ground. Larvae feed inside the gall, moving progressively upwards. They form typical buprestid tunnels with frass tamped into the tunnel behind them. An emergence hole is chewed to just below the bark by the mature larva and a frass plug is inserted. Pupation takes place in a chamber just beneath the frass plug (Fig. 4).

Although the larvae appear to damage the internal stem tissue extensively (Fig. 5), no effect on growth of the plant is visible. However, the stems are noticeably weakened which may result in wind or other mechanical damage.



4



5



6

Fig. 4. Pupal chamber and frass-plugged emergence hole in stem of *Gnidia burchelli*.

Fig. 5. Larval damage to internal stem tissue of *Gnidia burchelli*.

Fig. 6. Stem gall and emergence holes in *Gnidia burchelli* from *Sphenoptera* (*Tropeopeltis*) *gnidiaphaga* at type locality.

A second species, *S. (T.) stichai* Obenberger (det. S. Bílý), also appears to cause primary gall formation on *G. burchelli*. The two species seem to independently induce the galls and it appears that they partition this resource based on the size of the stems, with *S. (T.) stichai*, the smaller species, attacking the smaller diameter stems. The larvae of *S. (T.) stichai* are usually found alone just below the bark of the stems and although larvae of the two species sometimes occur in the stems concurrently, it is doubtful whether the association is an obligatory one.

Hesse (1934) discusses some insects associated with another species of *Gnidia*, *laxa* Gilg. in the western part of the Cape Province; among these is *Sphenoptera cupreosplendens* Laporte & Gory. He fully describes the larva and states that they tunnel and feed just under the bark at the base of the stem and in the roots, pupating at the base of the stem and roots. He makes no mention of the stems swelling because of the work of the buprestid, but does say that a weevil, *Hoplitopales lineatus* Boheman, causes a stem-thickening. We found no evidence that any other insects were involved in the stem galls of *G. burchelli*.

Sphenoptera (Tropeopeltis) loranthiphaga Bellamy, sp. nov.

Figs. 3, 7

Size moderate, 10.7–13.4 × 4.1–5.4 mm; elongate cymbiform; dorsally convex when viewed from side; color shining black; when fresh, covered with dusky brown pulverulence.

MALE. *Head:* Surface moderately punctate; flattened between eyes; supra-antennal carinae rounded, oblique, feebly elevated, medially joining at emarginate frontoclypeus; clypeus distally truncate, surface finely shagreened; labrum trapezoidal, narrower distally; eyes large, internal margins slightly diverging dorsally; antennal insertions widely separated; antenna with segment 3 about 2 × length of 2; 4 longer than 3, elongate, triangular; 5–11 subequal, each shorter than 4, with rounded serrate portion with sensory pores. *Pronotum:* 1.5 × wider than long; slightly wider at base; anterior margin sinuate, broadly rounded medially; basal margin trisinuate; lateral margin evenly arcuate in basal ½, then slightly indented and narrower in apical ⅓, laterally carinate to apical ⅓; disc flattened; surface moderately covered with very small punctures, sparsely so with larger punctures; scutellum transverse, flatly cordiform. *Elytra:* Wider than pronotum, widest opposite humeri; disc strongly, transversely and longitudinally convex in basal ⅓; lateral margins narrowing gradually from opposite humeri to before apical ¼, then slightly more abruptly to trispinose apices; medial spine slightly longer than sutural spine; sutural apices slightly separated; surface striatopunctate, interstices very finely punctate; lateral carinae extend to basal ½; epipleural fold very broad, costate to basal ⅓. *Ventral surface:* Prosternal process longitudinally excavated in midline; distally roundly truncate, laterally with preapical lobes; surface moderately punctate; sutures between abdominal sternites 2, 3, 4 and 5 broadly arcuate; sternite 5 roundly truncate distally. *Legs:* Femora fusiform; protibiae slightly arcuate; tarsal segments 1–4 with pulvilli, claws widely separated, slightly swollen basally. *Genitalia* as in Figure 3.

FEMALE. Differs from male by being generally more robust; sternite 5 more rounded apically.

VARIATION. Some specimens have irregular feebly elevated callosities on the frons and the lateral pronotal carinae not reaching to apical ⅓.

LARVA. Third instar 22–25 mm long; labrum trapezoidal, wider than long, widest distally, with four longitudinal sclerotized rods, two prelateral and one at either lateral ⅓; margin fringed with dense, short setae; mandibles apically tridentate.

MATERIAL EXAMINED. Holotype ♂ (TM): SOUTH AFRICA: Transvaal, Sartjiesnek, S25.46 E27.54, 18–20.XI.1983, C. L. Bellamy, beaten from foliage

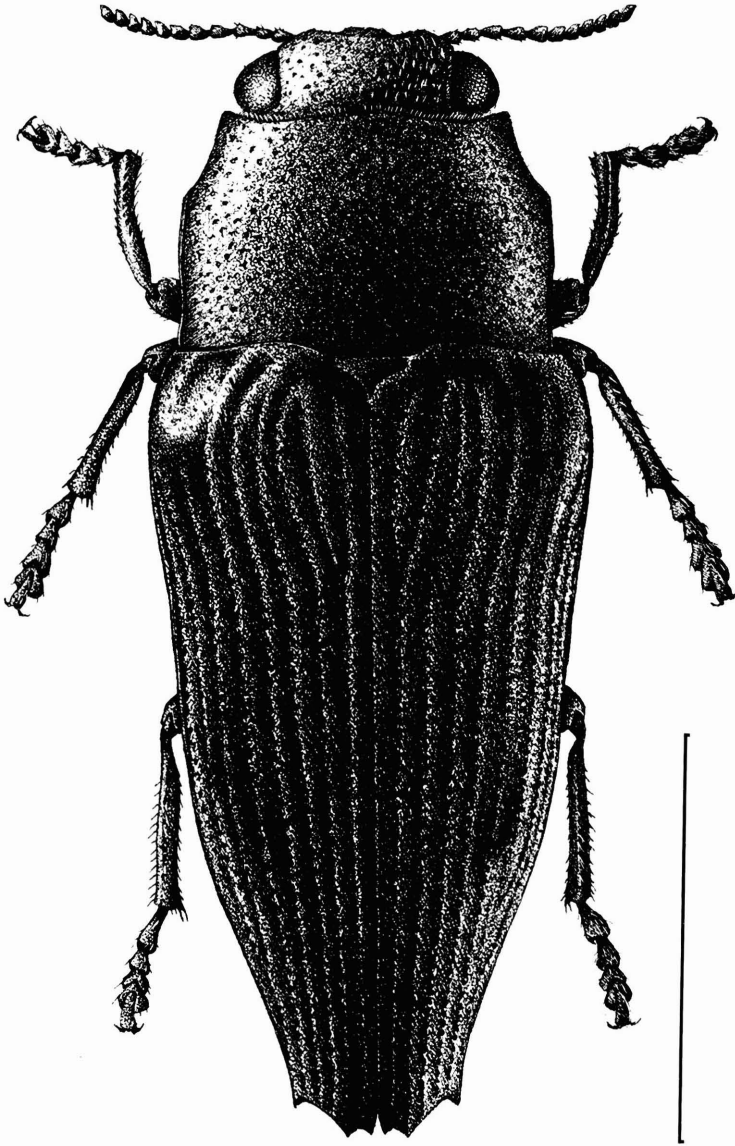


Fig. 7. *Sphenoptera (Tropeopeltis) loranthiphaga*, holotype (line = 5 mm).

Loranthus zeyheri Harv.; 29 paratypes as follows: 5 ♂♂, 3 ♀♀ same data as holotype; 2 ♂♂, 10 ♀♀ same data except, 12-17.XI.1983; 1 ♂, 1 ♀ same data except, 21-27.XI.1983; 2 ♀♀ same data except, 25.XII.1983, E. Holm; 1 ♀ 18 km. ESE Brits, S25.42 E27.53, 30.XI.XII.1984, C. L. Bellamy & D. d'Hotman; 1 ♂, 2 ♀♀, same data as holotype except, 1-2.XII.1984, C. L. Bellamy & D.

d'Hotman. Paratypes deposited in BMNH, CLBC, GAWC, GHNC, MNHN, NCI, NMP, RLWE and TM.

ETYMOLOGY. The name is derived from the host plant genus *Loranthus* and the Greek root *phag*, meaning "to eat."

REMARKS. *Sphenoptera* (*T.*) *loranthiphaga* comes closest to *S. (T.) pretoriensis* Kerremans, of which I have examined the unique type (TM). *Sphenoptera (T.) pretoriensis* differs by being more elongate-oval, having the scutellum more transverse, the elytra striate-costate and the sutural apical spine very reduced; also it is much less dorsally convex.

BIOLOGY. *Sphenoptera (T.) loranthiphaga* causes basal stem galls in the mistletoe, *Loranthus zeyheri* Harv., which is parasitic on *Acacia caffra* (Thunb.) Willd. in the Magaliesberg Mountains of the Transvaal.

Some basal swelling of *L. zeyheri* is normal, but galled plants usually swell around the point of infestation, which if low down is difficult to distinguish from the normal swelling, but if a little distance therefrom is quite distinct. No galls were found more than about 10 cm from the base.

Galls are monothalamous (one larva per gall) and most of the feeding takes place in the heartwood.

There is one generation per year. Adults emerge in summer (November, December) when mating and oviposition take place. Larval development proceeds until the following spring when pupation occurs. Adult eclosion follows a few weeks thereafter.

Hawkeswood and Peterson (1982) record *Stigmodera (Castiarina) producta* Saunders using *Muellerina eucalyptifolia* (DC.) Barlow (Loranthaceae) as a larval host. They state that this is the first record known to them of a buprestid developing within a species of either Loranthaceae or Viscaceae. More recently, Bellamy and Holm (1985) described a new genus and species of buprestid, *Cupriscobina loranthae*, from *Loranthus zeyheri*, presuming this to be the host. More intensive collecting of this interesting niche will probably yield additional new taxa and also allow the phylogenetic implications to be commented upon.

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