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A new seed beetle associated with *Indigofera zollingeriana* in Vietnam, with a note on the *Bruchidius japonicus* (Harold) species group (Coleoptera: Chrysomelidae: Bruchinae)

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Abstract. *Bruchidius zollingerianae*, a species that develops in the larval stage in *Indigofera zollingeriana* pods is described from Vietnam. Its relationships with other species known to feed in Indigofereae are discussed. The species group *Bruchidius japonicus* is described and discussed.

Key words: entomology, taxonomy, Coleoptera, seed beetle, *Bruchidius*, host plant, *Indigofera.*

INTRODUCTION

In two recent articles (Delobel & LeRü 2010a, b), we dealt with African species of *Bruchidius* whose larvae feed in the seeds of various *Indigofera* species. *Indigofera* is a large genus of about 700 tropical and subtropical species belonging to family Fabaceae, tribe Indigofereae. Until now, 26 species of seed beetles have been reported to feed in seeds of a slightly higher number of Indigofereae, with some beetles feeding in 2, 3 or more *Indigofera* species (*B. kingsolveri* Johnson has 8 known host plants). Of these 26 seed beetles, 17 live in Africa and/or Asia, 9 in America. New World species belong primarily to genus *Acanthoscelides*, with a few species in genera *Stator*, *Meibomeius* and *Margaritabruchus*. Asian and African species are usually placed in the large paraphyletic genus *Bruchidius*, with a few species sometimes in genus *Conicobruchus* (Kingsolver 1982, Johnson 1983, Udayagiri & Wadhi 1989, Johnson & Anton 1999, Delobel & Le Rü 2010a, b).

In Decembre 2009, we obtained specimens of an undescribed species of seed beetle from pod samples of *I. zollingeriana* Miquel collected in Vietnam. *I. zollingeriana* (also known as *I. benthamiana* Hance or *I. teysmannii* Miquel) is a 2 to 3 m. high perennial legume (Fabaceae, Indigofereae). It is widespread in South and Southeast Asia, as well in several Pacific Islands, where it may have been introduced (ILDIS 2010). No seed beetle has been so far recorded from that host plant. In fact, only three species of seed beetles have been reported to feed in *Indigofera* seeds in Asia, namely *Bruchus albopubens* Pic, *Bruchus indigoferae* Gyll., and *Bruchidius indigoferae* Tarlok Singh & Saini. *B. albopubens* was originally described from Sudan (Pic 1931); in Africa, its larvae develop in the seeds of *I. aspera* DC., *I. parviflora* Wight & Arn., *I. senegalensis* Lam., *I. tinctoria* L.; it has been reported in India and Pakistan from pods of *Cyamopsis tetragonoloba* (L.) Taub. and *Indigofera* sp.; authors placed it either in *Bruchidius* or in *Conicobruchus* (Arora 1977, Tarlok Singh 1979, Kingsolver 1982, Delobel & Le Rü 2010a). *Bruchus indigoferae* Gyll. was described from India; Johnson & Anton (1999) however consider that the species is actually of New World origin; they assume that the type specimen may have been introduced to India in indigo (*Indigofera tinctoria* L.) seeds, and place the species in *Acanthoscelides*. As for *B. indigoferae* Tarlok Singh & Saini, the same authors consider it as a synonym of *Bruchidius nalandus* (Pic) "with high probability"; it must however be noted that *B. nalandus* larvae feed in *Tephrosia* spp. seeds, whereas *B indigoferae* was reared from *Indigofera tinctoria* (as *I. tentoria*); the exact satus of the species remains therefore unclear.

METHODS

Pods were collected in December in the Tri An forest, between mileposts 15 and 16 of the ĐT (provincial road) 761, about 2.5 km south of Phân Trường 3 village, Vĩnh Cửu district of Đồng Nai Province (approximate coordinates: 11°14'08"N, 107°04'25"E). In this area, *I. zollingeriana* trees blossom during the rainy season (July to October), and at the time of collection, most of the non-deshiscent pods were completely ripe or partly decaying. When completely dry, pods or whole twigs may be broken off by the wind, and isolated seeds may fall to the ground after pericarp destruction; those were not collected. The host plant was identified using the Flora of Vietnam (Pham-Hoàng Hô 2002). Abbreviations used: MNHN, Muséum National d'Histoire Naturelle, Paris; NME, Naturkundemuseum, Stadtverwaltung Erfurt.

RESULTS

A total of 2900 pods were collected from two different trees and transferred to aerated plastic bags until emergence of beetles. The ripe pod of *I. zollingeriana* was subcylindrical, 35.5mm in length (range: 29.5 to 39.5mm), 4 to 5 mm in diameter. The mean number of viable (normal sized) seeds per pod was only 1.2 for one tree, 1.9 for the second (means of 30 pods), ranging from 0 to 6. According to Pham-Hoàng Hô (2002), the mean number of seeds per pod is higher than 10. Most collected pods actually contained a high proportion of unviable seeds, while many were heavily at-

tacked by a variety of agents feeding on seeds or pericarp, including birds, *Araecerus* sp. and unidentified Lepidoptera.

A total of seven specimens (2 males and 5 females) emerged within two weeks after sample collection. One female was transfered to 95% ethanol for DNA extraction. Examination of the sample revealed that 23 pods showed a seed beetle emergence hole, indicating that 16 adults had already emerged at the time of pod collection. Larvae fed on several (3 to 5) unripe seeds, but cocoon spinning and pupation did not take place within the seed, as is the case in most *Bruchidius* species: the whitish silk cocoon spun by the final instar larva was attached to the pod wall, much in the same way as *Conicobruchus strangulatus* (Fåhr.) larvae in *Crotalaria* pods. Migration of the last instar larva towards pod ends apparently occurred prior to pupation: in 15 cases (65% of pods), the larva fed on the first seed (nearest to the petiole) and spun its cocoon at the very proximal end of the pod; in six cases, the cocoon was located at the distal end of the pod; only in two cases had feeding and emergence taken place in the central part of the pod. This behavior is presumably related to the indehiscent nature of the host pod.

DESCRIPTION OF THE NEW SPECIES

***Bruchidius zollingerianae* sp. nov.**

Type material

Holotype: Male, VIETNAM, "Province Đồng Nai, Vĩnh Cửu, forêt Tri An, km15 ĐT761, 17.xii.2009, A. & H. Delobel" (dissected, genitalia in vial), MNHN. Paratypes: 1 male, Vĩnh An forest, km10 ĐT761, 19.i.2006, same host and collectors; 1 male, 4 females, same data as holotype, MNHN.

Description

Length (pronotum-pygidium): 2.4 – 2.6 mm; width: 1.5 mm.

Integument colour varying from light red brown to black, darker on face and thoracic sternites, at places on elytra; antennae light testaceous except apex of segment 10 and last segment, entirely darkened; anterior and median legs light testaceous; posterior legs reddish brown, with femora lighter.

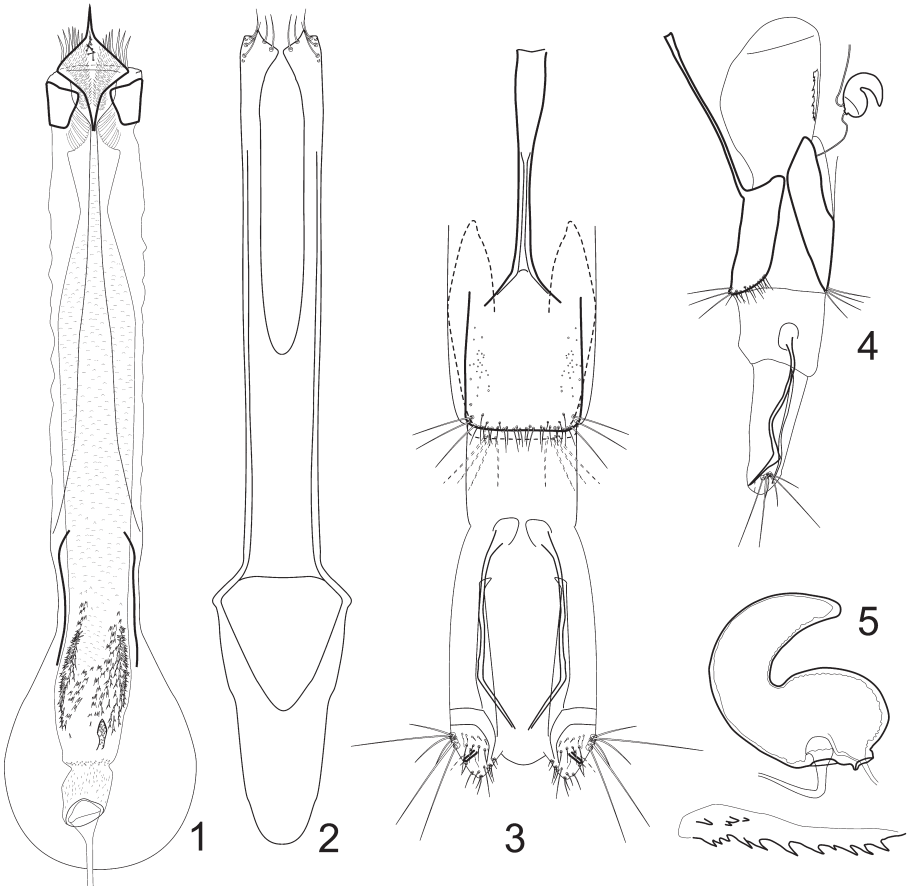
Vestiture dense, completely covering pronotum and elytra, made of long and thin setae, mainly light brown or orange, with whitish and black spots dorsally, light brown and white areas ventrally. Face yellowish, frons and vertex light brown; pronotum light brown and yellowish with darker spots and stripes; prescutellar bulge with light orange setae posteriorly and v-shaped (interrupted in middle) dark brown stripes anteriorly. Setation of elytra mainly light orange, with elongated brown or black and whitish spots in interstriae 2, 4, 6, 8; a striking black stripe in interstria 2 (and part of 1) between anterior 1/5 th and middle of elytra. Last visible abdominal tergite (pygidium) with white setation well covering intergument.

Male. Head moderately elongated; eyes strongly bulging, maximum head width about 1.5 width behind eyes; eyes separated by 0.2 times head width including eyes;

face rather narrow, with distance between posterior rim of eye and apex of clypeus / distance between eyes = 4.1; eye cleft to less than half its diameter, width at bottom of sinus composed of about 10 ommatidia; maximum width of postocular lobes equal to 1/5 eye width at sinus; carina on frons well defined, shining, interocular tubercule small.

Punctation of face small and sparse, vanishing on clypeus, with integument strongly alutaceous. Antenna long, reaching basal third of elytra; antennal segments 1 to 4 submoniliform, segment 2 0.7 times as long as 3, segments 4 and 5 of equal length, 5 slightly widened apically, 6-10 about 1.3 to 1.5 times longer than wide, 11 oval (L/W = 2.0). Length of antennomeres: 2.2; 1; 1.4; 2.2; 2.2; 2.0; 2.0; 2.1; 2.1; 2.0; 3.0.

Pronotum narrowly conical, with greatest width at base (W/L = 1.3), its sides straight, not expanded behind eyes, strongly bulging basally, without distinct oblique impression on sides of basal lobe. Pronotum with punctures strong, irregular, coalescent on disc, ocellate.



1-2. male genitalia of *Bruchidius zollingerianae*, ventral view: 1 − median lobe; 2 − lateral lobe and tegminal strut; 3-5. female genitalia of *Bruchidius zollingerianae*: 3 − ovipositor, ventral view; 4 − ovipositor, side view; 5 − spermatheca and sclerite of bursa copulatrix

Elytra 1.13 times longer than combined width, much wider basally than pronotum base; their sides parallel; scutellar area depressed; three small but distinct teeth at base of striae 3-5, their distance to elytral base slightly larger than distance between teeth 1 and 3. Striae on disc deep and narrow, with strong punctures; interstriae with strong microsculpture.

Hind femora moderately swollen, at their widest 2.7 times wider than mid femora; mesoventral margin with strong preapical denticle, ventrolatetral margin bulging opposite denticle, but not forming a distinct tooth; hind tibiae apically strongly widened, 2.5 times wider at apex than at base, with dorsomesal and ventral carinae complete, lateral strong but not reaching base, latero-ventral not reaching apex; apex of tibia with mucro about as long as width of tarsomere 1 at base; lateral denticle wide and acute, about 1/3 mucro length; dorsally a series of 5 to 6 minute teeth. First tarsomere ventrally with blunt denticle.

Abdomen with ventrite 5 emarginate, medially turned out, its length medially about 2/3 of sternite 4; ventrite 1 without particular arrangement of setae. Last visible abdominal tergite subtriangular, regularly convex, about as wide at base than long, with apex not turned under, briefly truncated.

Genitalia: Median lobe (Fig. 1) rather elongate (maximum width excluding basal hood / total length = 0.11), sides parallel, briefly narrowed before apex; basal hood small, subcircular, not emarginate; ventral valve wide basally, produced apically as a thin recurved beak, prolonged distally, with a single median row of small setae; no hinge sclerites, but instead the wall of the internal sac bears two dense groups of long, acute, flattened bristles or scales, the longest ones emerging as a fringe between ventral and dorsal valves; wall of internal sac lined with hyaline tubercles and multifid scales; saccus lined with two lateral groups of sclerotized needles, and with a small but strong sclerite with about 20 minute teeth; gonopore wide and subcircular, surrounded by minute hyaline needles. Basal strut without keel; lateral lobes cleft to about half their length; apex of parameres modified, with apical conical flap and internal projection, with only 5 long setae (Fig. 2).

Female. Similar to male, pygidium flattened over its whole surface; ventrite 1 without any particular arrangement of setae; ventrite 5 much longer than 4th. Genitalia: vagina membranous, bursa copulatrix with a faintly sclerotized sclerite bearing a series of small teeth; ovipositor (Fig. 3, 4) moderately elongated, with long, flattened spiculum gastrale; segment IX wide, longitudinal apodemes strongly arched; spermathecal body ovoid, with apical diverticulum stout, evenly curved; opening of the spermathecal gland duct slightly protruding, distinct from spermathecal duct opening (Fig. 5).

Affinities

Size, general body shape and colour pattern are quite similar with those of certain *Callosobruchus*, in particular with *C. theobromae* (L.); the new species differs however markedly in genital morphology. It has close affinities with a few Eastern Palaearctic *Bruchidius* species (see below).

Etymology

Forged latin adjective (feminine genitive), from the host plant specific name, *zollingeriana*.

Host plants

Larvae develop in the pods of *Indigofera zollingeriana*; the species is widespread in Southeast Asia, also introduced in India, Sri Lanka and Jamaica (ILDIS 2010).

Distribution

Vietnam.

THE *BRUCHIDIUS JAPONICUS* SPECIES GROUP

The new species belongs to the *Bruchidius japonicus* group of species, which shares the following characters: ventral valve acute, with small setae arranged in a single longitudinal row; proximal part of endophallus with long flattened scales emerging from behind ventral valve; saccus usually with a single sclerite with minute teeth; basal strut without keel; parameres fused on at least half their length, with a small number of setae; pronotum with bulging antescutellar lobes; hind femur moderately widened, its ventral margin with well developped internal spine and faint lobe on external side. This combination of characters is apparently unique among Bruchinae; similarities observed with *Callosobruchus* are superficial and delusive, as indicated by genital morphology: in addition to the lack of apical fringe in the median lobe, in *Callosobruchus* the ventral (exophallic) valve is triangular or spear-headed, and the number of endophallic plates (when present) is always even (Tuda *et al*. 2006).

The following *Bruchidius* species belong to the same group: *B. japonicus* (Harold), *B. kiritschenkoi* Egorov & Ter-Minassian, *B. lespedezae* (Iablokov-Khnzorian) (see Borowiec 1983, Morimoto 1990). The distribution of these three closely related species is usually described as Eastern Palearctic (from Russian Far-East to Northern China, Korea and Japan). A male specimen of *B. japonicus* [Bagmati Nuwakot, 1900m, Pati Bhanyang, 16-19.vi.1989, C. Holzschuh] was however found in a small series of specimens from Nepal kindly lent to me by NME. It differs from Japanese specimens in MNHN collections only in endophallic sclerite size (about three times longer) and in antennal colour (darkened from 5th antennomere). Such differences would possibly justify a status of subspecies, but data are far from sufficient to assess the precise status of populations involved.

It is worth noting here that both *B. japonicus* and *B. lespedezae* were obtained from *Lespedeza*, a genus that is not closely related with *Indigofera*, as it belongs to the tribe Desmodieae. The new species is presently the only tropical species of the group, and also the only one that was bred from seeds of a member of tribe Indigofereae. A small number of Indian species were described by Arora (1980) as having a dorsal valve "produced into a triangular (in fact quadrangular) process" (*B. dorsivalvia*), "with a median disc-shaped sclerorization" (*B. punctoterminalis*) or "consisting of two lateral, almost conical plates" (*B. orissiensis*). They possibly belong to the present group, even

though none of them shows the fringe of elongated scales observed here. Sampling Indigofereae and Desmodieae in Central and Southern China would certainly help shedding an new light on our understanding of the group.

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