

**Experimental hybridization
of two Chinese *Carabus* belonging to
the subgenus *Acoptolabrus* Morawitz, 1886
(Coleoptera, Carabidae)**

par

DANIEL DUBOIS* and PATRICE RENAUT**

* 143, chemin de Bourdin

F-13530 Trets

<daniel.dubois038@orange.fr >

** 3, ruelle de Plombières

F-21121 Hauteville lès Dijon

<p.renaut@hotmail.fr >

Résumé

Le croisement de deux espèces sympatriques de la province du Liaoning, *Carabus (Acoptolabrus) schrencki hisakai* Imura, 1990, et *Carabus (Acoptolabrus) constricticollis constricticollis* Kraatz, 1886, a permis d'obtenir les hybrides correspondants. Ces hybrides expérimentaux peuvent servir de référence pour déterminer si une hybridation entre ces deux espèces se produit dans la nature. Compte tenu de la facilité avec laquelle *C. (Acoptolabrus) schrencki hisakai* s'hybride, nous pensons que cette probabilité est élevée.

Abstract

The crossing of two sympatric species from Liaoning Province, *Carabus (Acoptolabrus) schrencki hisakai* Imura, 1990, and *Carabus (Acoptolabrus) constricticollis constricticollis* Kraatz, 1886, resulted in the corresponding hybrids. These experimental hybrids may serve as references to determine whether hybridization between these two species occurs in nature. Given the ease with which *C. (Acoptolabrus) schrencki hisakai* hybridizes, this probability appears to be high.

Keywords

Coleoptera, Carabidae, *Carabus*, *Acoptolabrus*, hybridization, China.

The subgenus *Acoptolabrus* Morawitz, 1886, has a wide distribution range comprising Russia, China, Korea and Japan. To our knowledge, the only known natural *Acoptolabrus* hybrid described in the literature results from the crossing of the sympatric *C. (Acoptolabrus) changgeonleei* Ishikawa & Kim, 1983, and *C. (A.) constricticollis chiricola* Kwon & Lee, 1984, found in Mt. Chiri (Jirisan), South Korea (Imura, 1994). Recently, Deuve moved this Korean *C. (A.) constricticollis chiricola* to a “strong” subspecies of *C. (A.) leechi* Bates, 1888 (Deuve, 2025).

Some other *C. (Acoptolabrus)* species are sympatric. In particular, in the Northeast China, especially in Liaoning, *C. (A.) constricticollis* population shares the same area as *C. (A.) schrencki hisakai* Imura, 1990 (Rapuzzi *et al.*, 2012). To date, no hybrid between these two species was reported. Given that *C. (A.) schrencki hisakai* hybridizes easily (Dubois, 2015), we believe that it is likely that natural hybrids will eventually be discovered in nature, particularly in this region.

During our investigation of the genetic proximity of some Asian *Carabus* (Dubois, 2013, 2015; Dubois & Renaut, 2022, 2026), we have already published some intersubgeneric hybrids between *Acoptolabrus* and *Coptolabrus* and between *Acoptolabrus* and *Damaster* (Dubois, 2015), obtained by experimental crossings of virgin individuals. In this paper, we report the crossing of *C. (A.) constricticollis constricticollis* Kraatz, 1886, with *C. (A.) schrencki hisakai* Imura, 1990, affording the corresponding healthy hybrids which represent the first known experimental hybrids between two species of this subgenus. They can serve as references if natural hybrids are discovered.

Materials and methods

C. (A.) constricticollis constricticollis Kraatz, 1886, were collected from Miaoyang, Fengcheng City, Liaoning, China.

C. (A.) schrencki hisakai, Imura 1990, were collected from Mt. Lu-wang, Dashiqiao City, Liaoning, China.

Breeding and hybridization experiments were conducted under the now well-established conditions (Malausa, 1977) which proved to be appropriate for these *Acoptolabrus* species. The crossing experiments require virgin individuals, so we first made strains of the two taxa collected in the wild. Then crossings in both directions were performed using one or a few pairs of the corresponding virgin parents.

Experimental results and discussion

The crossing of the two sympatric *Acoptolabrus* species leads to well-shaped and healthy hybrids: ♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.)*

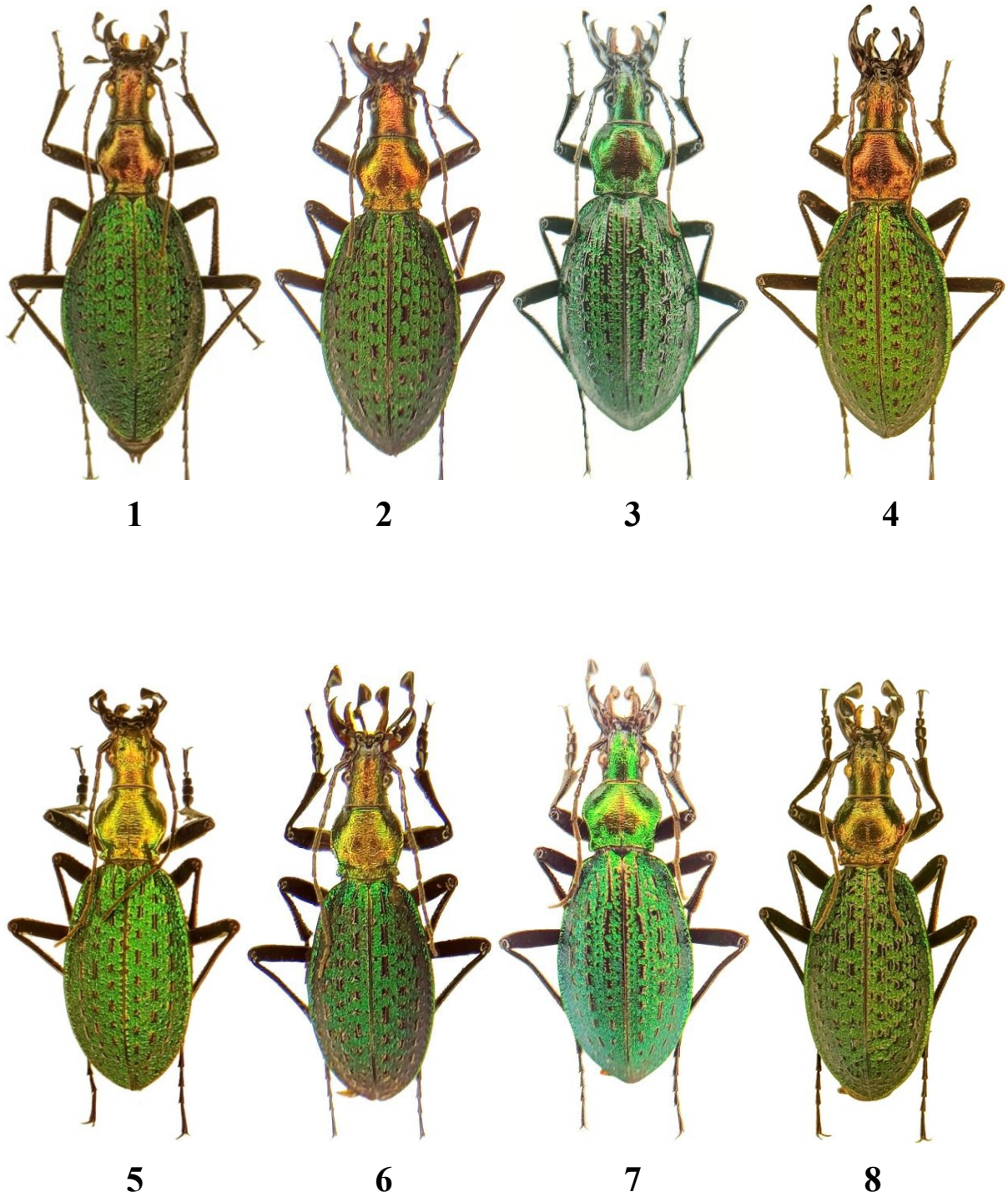


Fig. 1-8: 1, ♀ *C. (Acoptolabrus) constricticollis constricticollis*. – 2, ♀ [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 3, ♀ [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*]. – 4, ♀ *C. (A.) schrencki hisakai*. – 5, ♂ *C. (A.) constricticollis constricticollis*. – 6, ♂ [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 7, ♂ [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*]. – 8, ♂ *C. (A.) schrencki hisakai*.

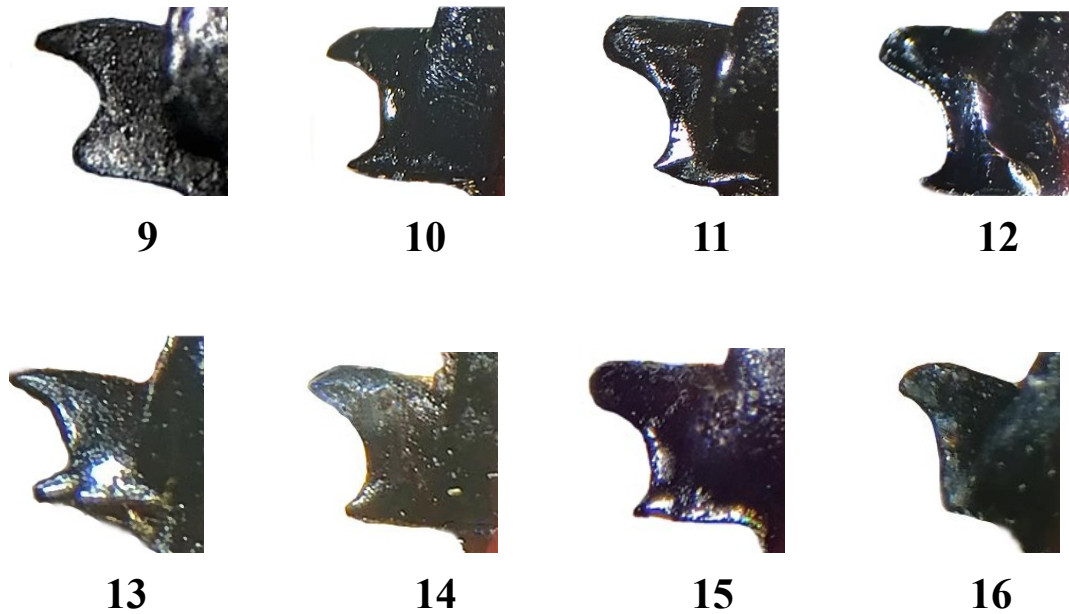


Fig. 9-16 : Right mandibular retinaculum shape of parental species and the corresponding hybrids. – 9, ♀ *C. (Acoptolabrus) constricticollis constricticollis*. – 10, ♀ [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 11, ♀ [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*]. – 12 ♀ *C. (A.) schrencki hisakai*. – 13, ♂ *C. (A.) constricticollis constricticollis*. – 14, ♂ [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 15, ♂ [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*]. – 16, ♂ *C. (A.) schrencki hisakai*.

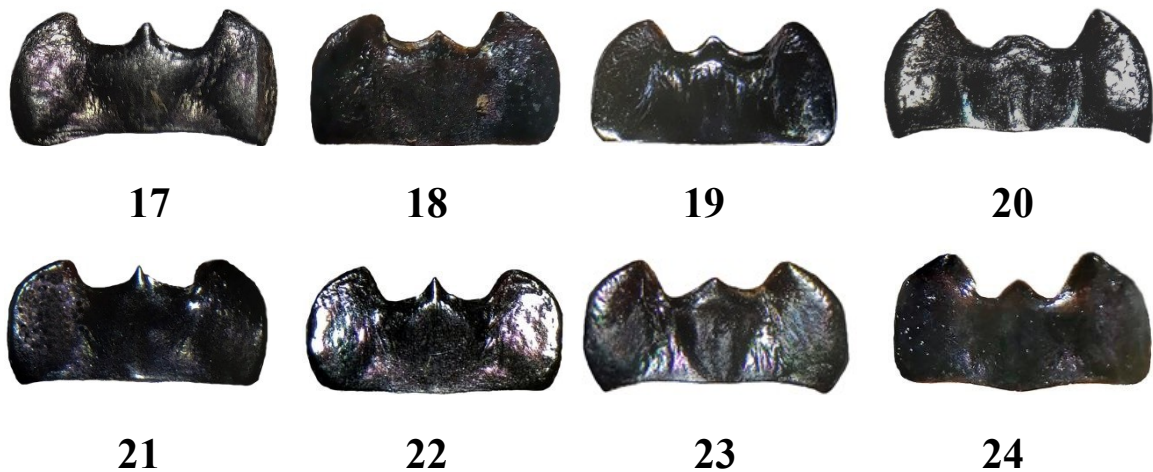


Fig. 17-24: Mentum shape of parental species and the corresponding hybrids. – 17, ♀ *C. (Acoptolabrus) constricticollis constricticollis*. – 18, ♀ [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 19, ♀ [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*]. – 20, ♀ *C. (A.) schrencki hisakai*. – 21, ♂ *C. (A.) constricticollis constricticollis*. – 22, ♂ [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 23, ♂ [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*]. – 24, ♂ *C. (A.) schrencki hisakai*.



Fig. 25. – Mating of ♀ *Carabus (Acoptolabrus) constricticollis constricticollis* with ♂ *C. (A.) schrencki hisakai*.



Fig. 26-28 : Comparison of elytral shape of both parental species and corresponding hybrid. – 26, ♀ *C. (A.) constricticollis constricticollis*. – 27, ♀ [*C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*]. – 28, ♀ *C. (A.) schrencki hisakai*.

schrencki hisakai. Figure 25 shows a mating leading to these hybrids. The total duration of the development from larval first stage is about 70-80 days at room temperature (20-22°C).

Similarly, we obtained the hybrids in the opposite direction crossing ♀ *C. (A.) schrencki hisakai* with ♂ *C. (A.) constricticollis constricticollis*. We did not observe any differences between the overall duration of development. This experiment led to well-shaped and healthy corresponding hybrids.

The two parental species phenotypes are very similar (Fig. 1, 4, 5, 8, 26, 28). The main differential criterion is the neck of *C. (A.) constricticollis constricticollis* which is clearly narrower than that of *C. (A.) schrencki hisakai* (Fig. 1, 5 versus 4, 8). The neck of the hybrids [♀ *C. (A.) constricticollis constricticollis* × ♂ *C. (A.) schrencki hisakai*] (Fig. 2, 6) is slightly narrower, especially that of the female, but this feature is not visible on the hybrids obtained from the opposite direction: [♀ *C. (A.) schrencki hisakai* × ♂ *C. (A.) constricticollis constricticollis*] (Fig. 3, 7). However, careful analysis of the right mandibular retinaculum from the dorsal view and the mentum from the ventral view show clear differences of the hybrids compared to the parental species. Retinaculum of hybrids displays an intermediate shape between the teeth of the male and female parents, depending on which tooth is compared to the parental tooth (Fig. 9-16). Comparison of the mentum shapes of the hybrids is more reliable, as they show clearly an intermediate state between the two parental species (Fig. 17-24).

In summary, experimental hybridization of *C. (Acoptolabrus)* species is feasible, providing well-formed individuals that may serve as references for recognizing possible natural hybrids.

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