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Morphological adaptations for respiration in Cryptococcidae (Hemiptera: Coccinea) occurring in Poland

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ABSTRACT. The size and location of spiracles and size of clypeo-labral shield were analysed in *Cryptococcus fagisuga* LINDINGER and *Pseudochermes fraxini* (KALTENBACH). In these species the access of air to spiracles is hindered due to their living in bark crevices of trees. Morphological adaptation to these unfavourable oxic conditions is the location of spiracles in deep cavities of sclerotized wall which, presumably, contain air reserves being the source of oxygen. In both species the clypeo-labral shields are very large, which is an adaptation to feeding in woody parts of plants and to living in unfavourable oxic conditions.

KEY WORDS: Hemiptera, Coccinea, *Cryptococcus fagisuga* LINDINGER, *Pseudochermes fraxini* (KALTENBACH), spiracles, clypeo-labral shield, size, location, oxic conditions.

INTRODUCTION

Examination of spiracles in some members of Coccidae revealed that their size and location depend on the body shape, permeability of their derm and covers for gases and on the access of air to spiracles. In many scale insects the fulfilment of oxygen demands is hampered. For example, the access of air to spiracles is hindered in legless individuals which adhere with ventral side of their body to plant surfaces living entirely sedentary way of life. These insects developed special adaptations for coping with the limited supply. In legless adult females of *Scythia festuceti* (ŠULC) the spiracles are located in deep cavities of sclerotised walls. Presumably the cavities contain air reserve, which is the source of oxygen (PODSIADLO 2005).

Moreover, it was found that the large spiracle size was often accompanied by increased size of clypeo-labral shield, which is the place of attachment of mandibulo-maxillary muscles. It was thus concluded that movements of these muscles i.e. their contractions and relaxations stimulate gas exchange. Larger size of clypeo-labral shield indicate stronger

development of these muscles and, consequently, more intensive respiratory movements. The size of clypeo-labral shield might also depend, however, on other factors. One might expect that feeding on woody parts of plants requires more power for piercing and sucking. Therefore, species settled on trunks and thick branches should possess better developed mandibulo-maxillary muscles and consequently, the clypeo-labral shield larger than the species feeding on soft parts of plants (PODSIADLO 2005).

This paper was aimed at studying morphological adaptation for respiration in representatives of Cryptococcidae living in Poland.

Cryptococcidae - bark-crevice scales are represented in Poland by two species: *Cryptococcus fagisuga* LINDINGER – the beech scale and *Pseudochermes fraxini* (KALTENBACH) – the ash bark scale. In Poland *C. fagisuga* is noted only on *Fagus silvatica* L. and *P. fraxini* – on *Fraxinus* (KAWECKI 1985). Both species live in bark crevices of trees.

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MATERIAL AND METHOD

Cryptococcus fagisuga LINDINGER: 24 ♀♀ on *Fagus silvatica* L. in Ustronie near Kępno (Poland, 26 June – 28 June 2002) collected by E. PODSIADLO.

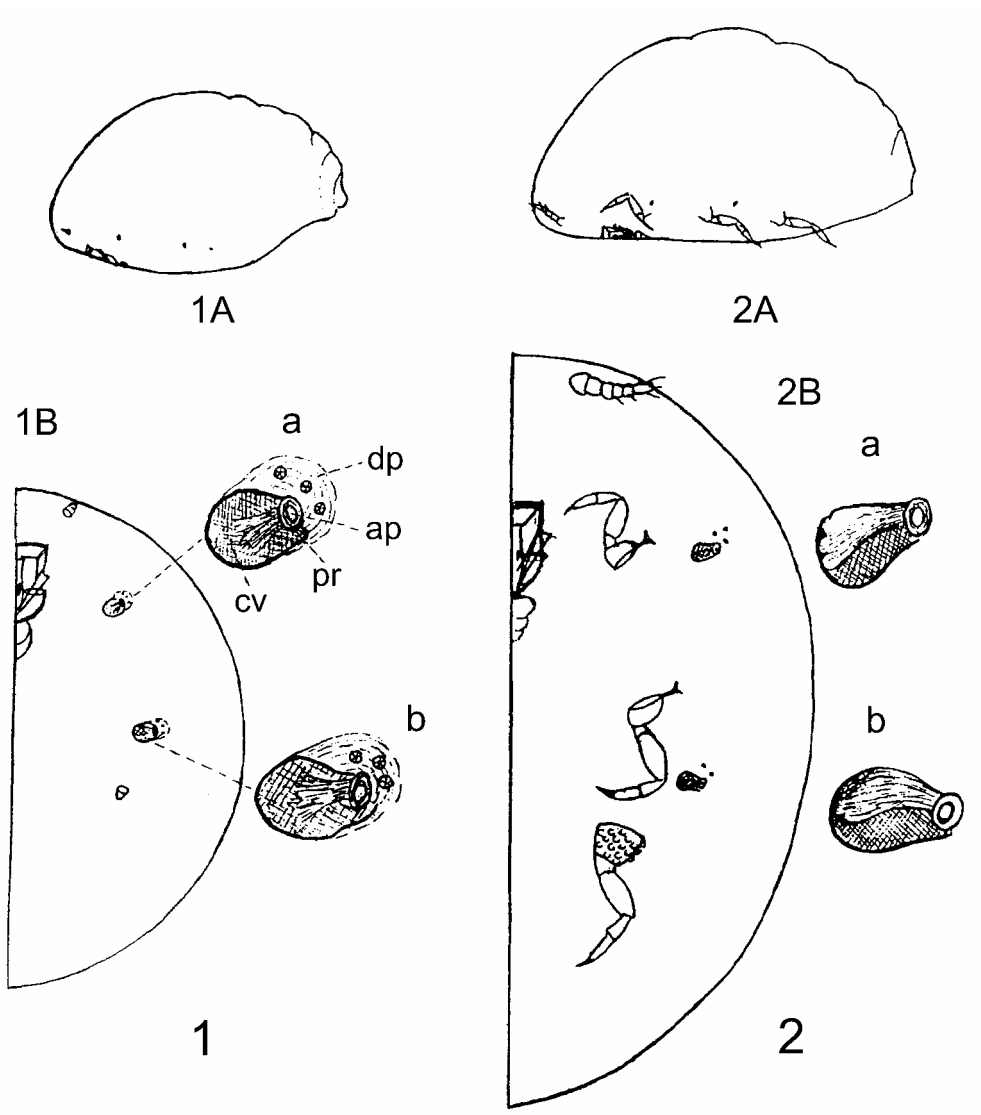
Pseudochermes fraxini (KALTENBACH): 6 ♀♀ on *Fraxinus* sp. in Świnoujście (Poland, 2 July 1961), 12 ♀♀ on *Fraxinus excelsior* L. in the Kampinos National Park (Poland, 25 Aug. 1978) collected by H. KOMOSIŃSKA.

Unmounted individuals were observed under an Olympus stereomicroscope. The stained mounted specimens were examined under an Olympus microscope. Measurements (in micrometers) are presented as averages followed by ranges in parentheses. The illustrations of slide mounted specimens were drawn using a microscope drawing tube attached to a microscope.

RESULTS

As mentioned above, the two species show a similar way of life feeding in bark crevices of trees. Their adult females are also similar in body shape being broadly oval or nearly circular and strongly convex (Figs 1–2). Their derm is membranous and slightly sclerotized. Both are covered with waxen ovisac. A striking difference between them is the presence of legs in *P. fraxini* and their reduction in *C. fagisuga*. The access of air to spiracles is limited in both species - when feeding in bark crevices they remain pressed with their ventral side into a tight space. Therefore, spiracles in both species are situated in deep cavities of sclerotised walls (Figs 1–2) like those in *S. festuceti*. In *C. fagisuga* the cavities

are a little smaller than in *P. fraxini* in keeping with its smaller body size (Table 1). In *C. fagisuga*, however, the cavities are located in depressions of slightly sclerotized walls. That way, the cavities and depressions together contain more air than the cavities in *P. fraxini* alone. This might be explained as an adaptation to worse oxic conditions resulting from the lack of legs in the former.



Figs 1–2. Adult females: 1 - *Cryptococcus fagisuga* LINDINGER; 2 - Pse*udochermes fraxini* (KALTENBACH). A - lateral view, B - ventral side; a - anterior spiracle, b - posterior spiracle. Abbreviations: ap - aperture, pr - peritreme, cv - cavity, dp - depression.

In both species the clypeo-labral shield is very large (Table 1) which might be explained by feeding on woody parts plants, but also by enhanced activity of mandibulo-maxillary muscles due to unfavourable oxic conditions. The latter arise not only from restricted access of air to spiracles but also from the convex body shape (low surface /volume ratio) and the presence of covers which hamper cutaneous respiration.

Table 1. Measurements of the body size, the clypeo-labral shield and spiracles in Cry*ptococcus fagisuga* LINDINGER and *Pseudochermes fraxini* (KALTENBACH).

			Cryptococcus fagisuga	*Pseudochermes fraxini*
body size of slide-mounted specimens		length	604 (500-730)	940 (740-1140)
		width	544 (440-670)	716 (600-880)
clypeo-labral shield		length	96.9 (90.0-110.0)	105.1 (95.0-110.0)
		width	78.4 (70.0-90.0)	83.7 (72.5-95.0)
anterior spiracles	cavity	length	26.5 (25.0-30.0)	28.6 (25.5-32.5)
		width	19.0 (17.5-21.5)	19.9 (17.5-22.5)
	peritreme	diameter	8.1 (7.5-10.0)	8.5 (8.0-9.0)
	aperture	diameter	4.5 (4.0-5.0)	4.2 (4.0-5.0)
posterior spiracles	cavity	length	27.4 (25.0-30.0)	29.7 (27.0-32.5)
		width	18.8 (17.5-22.5)	21.2 (17.5-22.5)
	peritreme	diameter	9.7 (8.5-10.0)	9.2 (8.5-10.0)
	aperture	diameter	4.6 (4.0-5.0)	5.0 (5.0)

CONCLUSIONS

In adult females of *Cryptococcus fagisuga* LINDINGER and *Pseudochermes fraxini* (KALTENBACH) (Cryptococcidae) having restricted access of oxygen to spiracles the adaptations for respiration are similar to those in *Scyhtia festuceti* (ŠULC) (Coccidae). Spiracles are located in deep cavities of sclerotised walls which probably contain air reserves being the source of oxygen.

In both *C. fagisuga* and *P. fraxini* the clypeo-labral shields are very large which is the adaptation to feeding on woody parts of plants and to living in unfavourable oxic conditions.

REFERENCES

KAWECKI Z. 1985. Czerwce [Scale insects], Coccoidea. Katalog Fauny Polski 21(5), **39**: 1–108. [In Polish].

PODSIADŁO E. 2005. Morphological adaptations for respiration in Coccidae (Hemiptera: Coccinea). Polskie Pismo Entomologiczne **74**: 423–430.

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