INTRODUCTION

Tornabea is a monotypic genus characterized by corticated lobes with thick walled longitudinal hyphae, septate brown ascospores, lecanorine apothecia with thin thalline exciple, bitunicate asci with an amyloid tholus, and three strong disjunctions in the pattern of distribution (Purvis et al., 1992; Nimis and Tretiach, 1997). Tornabea scutellifera (With.) J. R. Laundon a member of Physciaceae, is a highly polymorphic fruticose, mostly epiphytic species without lichen substances. It is widely distributed in the old and new world with three varietal ranks including cylindrica, intricata, and spinifera (Tavares, 1957; Kurokowa, 1962; Nimis and Tretiach, 1997). Based on former records of its distribution in the Irano-touranian region, it was restricted to coastal and mountainous habitats (Nimis and Tretiach, 1997), but during the last decade it has also been found in coastal habitats of the Khazar Sea and in Golestan Natural Park in the Siberian (Seaward et al., 2008), Zanjan province (Sohrabi et al., 2010), and Darkesh reserved region (Northern Khorasan province) in mountainous semi-arid regions (Haji Moniri and Sipman, 2011).

Apparently, T. scutellifera and some species of Seirophora are naturally good neighbors independent of the substrate, as exemplified by Nimis and Tretiach (1997) who found it together with Seirophora villosa (Ach.) Norman and S. californica Sipman. It has also been recorded with S. contortuplicata (Ach.) Frödén on calcareous rock (Sohrabi et al., 2010), and with S. austroarabica (Sipman) Frödén on Quercus castaneifolia (Haji Moniri and Sipman, 2011). In October of 2004 and March of 2005, the second author undertook lichenological survey of the Darkesh reserved region (37°24’-37°27’N, 56°4’-56°49’E) in Northern Khorasan province. This c. 4000 hectare survey site is located at altitudes ranging 1100 to 2450 m in the Ala Dagh, about 75 km west of the town of Bojnord (Fig. 1), where annual precipitation is c. 500 mm, the average temperature is 15°C, and a mainly western wind has an average speed of 8.7 ms⁻¹ (Anonymous, 1994). The complex topography and habitat heterogeneity, in addition to the influence of the Caspian, Siberian and Mediterranean climate, have resulted in the formation of diverse vegetation. It is home to at least 506 vascular species (Aidani 2004), of which, such as Acer monspessulanum subsp. turcomanicum (Pojak.) Rech. f., Salix aegyptiaca L., Juniperus sabina L., Pyrus boissieri Boiss. & Buhse, Quercus castaneifolia C. A. Mey. subsp. Castaneifolia and Crataegus pentagyna Waldst. & Kit., have a very important role as lichen substrates. Lichens identified from the site comprise 51 species from 32 genera (Seaward et al., 2008; Haji Moniri and Kukwa, 2009; and Haji Moniri and Sipman, 2009, 2011). The present study has been made on morphology, anatomy and chemistry of Tornabea scutellifera occurring on bark and twigs of Quercus castaneifolia and Crataegus pentagyna.

MATERIALS AND METHODS

Significant quantities of the samples (herb. nos of 1989-1998, 2002 and 2004) previously identified as T. scutellifera, collected from the bark and twigs of living Q. castaneifolia and C. pentagyna, were studied morphologically and anatomically and subjected to chemical analysis. Vouchers are deposited in the private...
lichen collection of the second author with duplicates in herb. Seaward (Nos. 1989, 1990 and 1993) and in the Botanical Garden and Museum, Berlin (No. 2002). All specimens were studied with a Nikon Ys2-T light microscope using hand-sections in distilled water. Light microscopy measurements were done by means of Dino Capture 2.0. Specimens were spot tested with routine reagents and examined with standardized biochemical methods for finding probable none identifies substances by TLC (Purvis et al., 1992). Three gram of thalli together with reagents such as Guaiacol and 4-aminoantypyrine respectively was taken for assay. The methods such as ion exchange chromatography and zymography were used for peroxidase assay (Mc-Adam et al., 1992; Schagger 2006).

RESULTS AND DISCUSSION

Thallus (Figs. 2-4) fruticose with thickening of 15-70 μm, secondary branches dichotomous, c. 30-55 μm thick at the base, with tufted and irregular branches, c. 35-50 μm thick, gradually narrowing to 4-20 μm at the apex, covered with hairs, 1-3 × 4-5 μm; surface matt, usually grayish green, light grey to brown, rarely reddish brown. Cortex thin, 2-3 μm thick, consisting of distinct thick walled hyphae; algal layer Trebouxia-type, more or less immersed in cortex, clustered, with 12-18 algal cells per one mm² (Fig. 5); medulla lax, colourless, made of crossed hyphae, broadening towards the apex (Fig. 6). Apothecia sessile, lecanorine, 3-8 mm in diam.; thalline margin conspicuously thickened, c. 1 mm thick, persistent; disk deep grey to black-brown, more or less pruinose, convex (Fig. 7). Hypothecium usually 5-10 μm, brown. Hymenium 55-60 μm tall, colourless. Epithecium 14-20 μm thick, beige to light brown. Paraphyses simple to moderately branched, apically swollen, with brown pigment apices (Fig. 8).

Asci 8-spored, clavate, 40-58 × 15-18 μm, lecanora-type,
Fig. 2. Habitat photograph of *Tornabea scutellifera*

Fig. 3. Overview of the fruticose channeled thallus.

Fig. 4. Close-up of Fig. 3.

Fig. 5. Trebouxia-type algae in among fungal hyphae.

Fig. 6. Light micrograph of a thallus cross section.

Fig. 7. Lecanorine apothecium of *Tornabea scutellifera*.
Amyloid in Lugol’s. Ascospore ellipsoid, brown, septate with no apical thickening, 22-43 × 10.5-20 μm [n= 30], no ornamentation visible by light microscopy (Fig. 9). Pycnidia (Fig. 10) common, immersed, with a brown ostiolum, pear-shaped, 312 × 169 μm, unilocular densely covered by several hyphal layers; conidia simple, broadly bacilliform, 3.5-4.5 × 1 μm [n= 50].

Chemistry: All spot tests negative, UV-. With difficulty, Guaiacol peroxidase enzyme assay was undertaken with Guaiacol led to a maximum absorbance of 0.1 at 436 nm and the protein quantification with Bradford Microassay Method proved to be 0.245 mg/ml, and specific activity of crude extract of the enzyme was 0.29 U/ml.

The significance of these observations for detecting the related variety are discussed. The morphological data correlate rather with results of the study by Tavares (1957); the evaluation of possible characters including abundant apothecia, intricate hairy branches are compared with var. intricata. We were not able to find the tendency of the formation of vegetative propagules in the studied material although Tavares (1957) had emphasized on. It seems that high frequency of ascocarps offset this feature. Thin cortex, cluster algal cells penetrate in the cortex, and lax medulla (Fig. 6) correspond to scutellifera-type anatomy collected from Persia (Kurokowa, 1962).

Tornabea scutellifera has a wide range of substrate such as soil, lignin, coastal bushes, siliceous rock, cement walls, Cactaceae and even it is vagrant (Nimis and Tretiach, 1997). As all our floristic knowledge is incomplete, Iranian samples have been recorded from three substrates including siliceous rock, Quercus and Crataegus pentagyna (Seawrd et al., 2008). According to the first author's observations in the field, Tornabea scutellifera is widely distributed on Quercus castaneifolia and Crataegus pentagyna, with large biomass at the lower of fog-belt.

REFERENCES