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## Hidden diversity of endoparasitic eriophyoid mites: two new *Novophytoptus* Roivainen, 1947 (Acari: Eriophyoidea: Phytoptidae) species from the parenchymatous tissues of rushes (Juncaceae)

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### Abstract

The monogeneric subfamily Novophytoptinae is a separate lineage of phytoptids restricted to endoparasitism on herbaceous monocots of the order Poales. Novophytoptines live under the epidermis of their hosts where they feed on parenchymatous cells and reproduce therein. It is unknown yet how novophytoptines penetrate the plant epidermis, but preliminary observations indicate that they might be able to penetrate through circular holes which they cut in the epidermis using their modified gnathosoma. Two new species, *Novophytoptus luzulis* n. sp. from *Luzula pilosa* L. and *Novophytoptus maritimus* n. sp. from *Juncus maritimus* Lam., are described and illustrated. Two small pores, presumably representing external openings of spermathecal tubes, were found in the postero-medial genital cuticle (*sensu* Chetverikov 2014b) at the level between the posterior margin of the genital coverflap and the genital rim, in both new species. This is the first documented report of such structures in slide-mounted eriophyoid mites. CLSM and DIC microscopy-based observations showed that novophytoptines possess a peculiar spermathecal apparatus, including greatly expanded sack-shaped spermathecae and thick, bent spermathecal tubes directed anteriorly, and a semicircular anterior genital apodeme perpendicular to the long body axis. Similarity in the structure of the spermathecal apparatus among novophytoptines, phytoptines and sierraphytoptines (all Phytoptidae from angiosperms) apparently supports their assignment to a common group. Additional examples of endoparasitism among Eriophyoidea are listed. The hypothesis of a primary endoparasitic life style in the eriophyoid basal stalk and a secondary shift to free living forms on exposed surfaces of plants is briefly discussed. Research on grass-associated endoparasitic mites is important because they may include new vectors of pathogens. SketchUp Free Software is recommended as one of the most simple and promising 3D drawing tools for modeling the internal genitalia and other complex anatomical structures of microarthropods (especially eriophyoids) based on digital data obtained using various microscopic techniques such as CLSM.

**Key words:** *Novophytoptus*, eriophyoids, monocots, reproductive systems, endoparasites, confocal microscopy, SketchUp

### Introduction

The monogeneric phytoptid subfamily Novophytoptinae (Roivainen, 1953) was originally proposed for an unusual eriophyoid mite, *Novophytoptus rostratae* Roivainen, 1947, found in the middle of the twentieth century on leaves of sedges in Finland. Six further species of this genus have since been described from Europe, North and South America (Table 1). Although such mites have never been observed in the process of feeding, all were found moving on the external surfaces of leaves. So, in original descriptions, novophytoptine mites have been described as “vagrant” and “causing no apparent damage”, except for *Novophytoptus sivai* Flechtmann, 2004 which was collected from leaf surfaces as well as from “...the spaces inside older leaves, intralaminar, from where they emerge in large numbers...” (Flechtmann 2004, p. 160). Six of the seven currently described *Novophytoptus* species inhabit sedges (Cyperaceae) or grasses (Poaceae) and only *Novophytoptus aculeatus* Pye, 2012 has been found on rushes (Juncaceae) (Table 1).

Two new *Novophytoptus* species, morphologically similar to *N. aculeatus*, from juncaceous plants were found.