Phloeotribus rhododactylus

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The bark beetle Phloeotribus rhododactylus feeds mainly on the shrub Cytisus scoparius. The range of P. rhododactylus extends from Spain in the south to southern Sweden, Denmark, and Scotland in the north. Its range to the east extends to Poland, Slovakia, and Hungary, but single localities are known further east in Romania, Bulgaria, and Greece. It is clear that the range of the beetle matches that of its main host. C. scoparius is adapted to Mediterranean and coastal climates, and its range is limited by low winter temperatures. P. rhododactylus is, therefore, rare in Central Europe. It infests either individuals of C. scoparius that have been damaged by mammalian herbivores or snow or that are drought-stressed. Although C. scoparius is an invasive plant in agricultural and natural ecosystems, P. rhododactylus has not been found in any of the areas where C. scoparius has invaded.

Keywords: Phloeotribus rhododactylus ; Scolytinae ; bark beetle

1. Introduction

Scolytinae (Coleoptera: Curculionidae) includes both bark and ambrosia beetles and represents species of major economic and ecological importance in forests worldwide [1][2]. Most scolytine species feed on recently cut or injured tissues of woody plants, and such feeding can cause massive tree mortality depending on both tree health and beetle abundance [3][4][5].

Although weakened trees (i.e., wind-fallen, fire-injured, water-stressed, or trees damaged by other biotic factors) are highly attractive to Scolytinae, healthy trees are rarely attacked [6], and less than 1% of scolytine species regularly kill healthy standing trees [7]. Scolytinae affect forest dynamics by contributing to decomposition and nutrient cycling [3][8].

The absolute majority of Scolytinae beetles perforate the bark of trees and dig galleries near the cambium, but bark and ambrosia beetles differ in their feeding strategies. Bark beetles are mostly monophagous or oligophagous species that feed directly on phloem tissues (i.e., phloemophagy), whereas ambrosia beetles are polyphagous species that feed on fungi that they introduce and cultivate in their galleries (i.e., xylomycetophagy) and on xylem [6][9][10][11]. The lack of host specificity contributes to the invasiveness of ambrosia beetles in many forest ecosystems [12][13].

Scolytinae have been studied more than any other group of forest insects, but most investigations have been restricted to only a few pest species; see [14]. The abundance of scolytids is generally explained by resource-related parameters. In contrast to their abundance, the pest status of scolytids was previously found to be significantly related to species-specific traits, such as body size and maximum number of generations per year [14]. The latter study did not include the bark beetle *Phloeotribus rhododactylus* (Marsham, 1802) because information on its hosts was lacking [14].

Phloeotribus rhododactylus feeds mainly on the shrub Cytisus scoparius (L.) Link, 1822. Other host plants include Spartium junceum L., 1753; Cytisus sp., Ulex europaeus L., 1753; Calicotome sp.; Coronilla emeroides Boiss. & Spruner, 1843; Genista florida L., 1759; Adenocarpus complicatus (L.) J. Gay ex Gren. & Godr., 1848; and Ficus carica L., 1753 [15][16][17]. This bark beetle was previously reported to occur mainly in Western Europe and, to a lesser degree, in Central Europe, where its occurrence diminishes to the east [15]. Although C. scoparius is known to occur in most areas in Central Europe, P. rhododactylus has been considered rare in Central Europe [18][19].

2. Geographic Range of *Phloeotribus rhododactylus*

The occurrence of P. rhododactylus has been already known in Western and Central Europe for a long time. In most countries, the first records date back to the 1950s, and only in few countries has it been reported later in the second part of the 20th century (Figure 1A,B), something that could be potentially associated with the low abundance of the insect. Even in one of the most comprehensive works on bark beetles based on extensive research by the author [20][21], the records of P. rhododactylus were mainly concentrated in Western Europe, being significantly rarer in the east [15].

Throughout the natural distribution of P. rhododactylus, we found records of its occurrence at 357 specific localities (Table 1). The number of localities is much greater for Western Europe (Great Britain, Germany, and France) than for Central or Eastern Europe (Figure 1A).

Table 1. Known localities of *Phloeotribus rhododactylus* in Europe. Data and localities are summarized based on the literature available from Google Scholar, Zobodat, Biodiversity Heritage Library, and www.gbif.org.

Country	Localities (County) and References
Austria	Karnburg [22]; Donnerskirchen, Eisenstadt, Gars, Gemeinlebarn, Horn, Stein an der Donau, Winden, Yois [23]; Niederdonau [24]; Helenental, Kalksburg [25]; Mitterberg [26]
Belgium	Antwerpen, Baileux, Borsbeek, Breuvanne, Cerfontaine, Cielle, Cour-sur-Heure, Dourbes, Eupen, Grandglise, Furnaux, Hantes-Wihéries, Hermeton-Sur-Meuse, Henripont, Jamiolle, Jamoigne, Lambermont, Marchienne-Au-Pont, Marloie, Meeuwen, Mont-Gauthier, Neeroeteren, Neufmoulin, Nivelet, Odrimont, Oignies-en-Thiérache, Rachecourt, Robelmont, Roelen, Samrée, Sosoye, Vodecée, Wauthier-Braine, Wilsele-Dorp, Zeveneken [27]
Bulgaria	Kaspichan [27]
Croatia	Draga, Krapina, Križevci, Orehovica, Sljeme, Trakoščan, Zagreb [28]
Denmark	Allinggård, Funder, Nørholm, Vejle [29]; Fuglsø [27]
France	Albaran, Avignon, Bassin de la Seine, Bois du Rouvray, Brout-Vernet, Corse, Env. de Rodez, Grocy, Hyères, Iles de la Loire, Isdes, Marcilly-en-Vilette, Marseille, Mers, Montfaucon, Montpellier, Mt. Ventoux, Murles, Peille, Sle.Maxime, Vosges [30]; Abzac, Belin-Béliet, Lège-Cap-Ferret, Le Verdon-Sur-Mer, Queyrac, Quinsac, Saucats [31]; Anost, Arandon, Archail, Arnières-sur-Iton, Beaumont du Ventoux, Bionville, Blagon, Bonnée, Brantes, Braux, Chambry, Champagne-sur-Seine, Champsecret, Chapeau, Chemilly, Cheval-Blanc, Cruzille, Eckartswiller, Eschbourg, Fontbelle, Héches, Henrichemont, La Borne, La Javie, La Môle, Lavault-de-Frétoy, Le Bourgneuf, L'Épine, Le Vallée Heureuse, Les Bréviaires, Les Choux, Les Ferrands, Les Mayons, Le Poët-Célard, Le Valtin, Maisse, Ménerbes, Méolans-Revel, Mijanés, Milly-la-Forêt, Mimizan, Monferran-Savès, Mongausy, Mons, Montigny-lès-Cormeilles, Mozac, Neuvy-sur-Barangeon, Nohédes, Orcemont, Ouzouer-sur-Loire, Raon-sur-Plaine, Revalies, Rotis, Sagy-le-Bas, Saint-Béat, Sainte-Geneviève-des-Bois, Saint Estéve, Sainte-Tulle, Saint-Floren, Saint-Lys, Saint-Pierre-du-Lorouër, Saintry-sur-Seine, Salerm, Sare, Saurat, Savigny-le-Temple, Sermoyer, Sotteville-lès-Rouen, Tartonne, Vergons, Vineuil-Saint-Firmin [27]
Germany	Nördlinger [32]; Bokelsberg, Göhrde [33]; Hamburg, Mecklenburg, Oldenburg, Pommern, Sachsen, Thüringen, Westfalen [34]; Baden, Bayern, Hessen, Nassau, Wurtemberg [35]; Lindenberg, Sasbachwalden [36]; Bad Herrenalb [37]; Freiburg in Breisgau [38]; Blankenburg, Halberstadt [39]; Bluno, Döberitz, Terra Nova [40]; Boostedt, Eilsdorf, Flittard, Heenes, Kleinraschütz, Nettekoven, Niederhausen, Pfeifenkrug [27]
Greece	Zachlorou [41]
Hungary	Budapest [42]; Szöce [43]; Vas [44]
Ireland	Cork, Dublin, Kerry, Wexford, Wicklow [45]
Italy	Vallombrosa [46]; Sardegna [47]; Sicilia [48]; Nuoro, Porta [49]; Fennhals, Oberfennberg [26]; Montegiovi [27]
Luxembourg	Goebelsmühle, Nordwestl. Altrier, N. Troisvierges, Südwestlich Berchem [50]; Hoscheid, Wahlhausen [51]; Luxembourg, Michelau, Rodenbourg, Sassel [27]
Netherlands	Huizen [52]; Amerongen, Baarn, Partij [27]
Poland	Gorzów Wielkopolski [53]; Pomorz Zachodni [54]; Brójce, Glińsk, Ołobok, Przygubiel, Rzeczyca [55]; Eastern Sudets Mts., Lower Silesia, Polanow, Trzebnica Hills, Western Beskid Mts. [56]; Kędrzyno [57]
Portugal	Pelados [58]
Romania	Domogled [42]
Russia—Kaliningrad	Gurevsky district [59]
Slovakia	Slovenský Búr [15]; Mlýňany [19]
Spain	Galicia [17]; Andorra, Barcelona, Valle de Arán [60]; País Vasco [61]; Salamanca [62]
Sweden	Norje, Vanneberga [27]
Switzerland	Mittelland [63]; Arbedo, Capolago, Caviano, Chiasso, Lavigny, Loco, Lugano, Morges [27]
Turkey	Antalya [64]

Country	Localities (County) and References
United Kingdom	**Bewdley Forest, Birch Wood, Chatham, Coombe Wood, Darenth, Dartford, Durham, Eastbourne, Forth, Herefordshire, Liverpool, Mickleham, Monmouthshire, Moray, New Forest, Northumberland, Reigate, Rusper, Scarborough, Sheerness, Shirley, Shirley Warren, Southampton, Southend, Southsea, Tay, Tweed, West Wickham, Whitstable, Wimbledon, Woking [65]; Aberdeen [66]; Ainsdale-on-Sea, Aldridge, Annan, Ashford, Ashtead, Aycliff, Aylesford, Barston, Bermuda, Bewbush, Binley Woods, Bishop's Castle, Blackborough End, Blythburg, Botcherby, Brancaster, Bredgar, Castle Rising, Charleston, Chithurst, Claydon, Coventry, Dale, Derwen Fawr, Dinas Dinlle, Donnigton, Dordon, Downside, Dungeness, Eyke, Eythorne, Ferndown, Foel, Frodesley, Garboldisham, Gladestry, Glan-yr-afon, Gooderstone, Great Hockham, Gretna, Great Wenham, Gumley, Gwbert, Hales Place, Hartfield, Hornton, Hoylake, Kidderminster, Kingston upon Thames, Knockin, Lakenheath, Langwathby, Llangaffo, Longfield, Maltby, Marholm, Moriah, Muddles Green, Mundford, Nantmel, Narborough, Newcastle, Newton, Newton St. Faith, North Wootton, Orford, Pennparcau, Pennrhos Garnedd, Petworth, Port Talbot, Priors Hardwick, Red Lodge, Richings Park, Riddlesworth, Ruthin, Ruyton-Xl-Towns, Seale, Sea Palling, Selattyn, Stratford-upon-Avon, Swansea, Tankersley, Tattingstone, Thetford, Ullenhall, Undley, Upper Whiston, Walsall, Walton, Washington, Wealden, West Bay, Whitwell, Wimborne Minster, Winchelsea, Wolverhampton, Woolston, Wootton [27]**

The range of P. rhododactylus extends to Spain (probably northern Spain) in the south and to southern Sweden, Denmark, and Scotland in the north. The range to the east extends to Poland, Slovakia, and Hungary, but single localities are known further to the east in Romania, Bulgaria, and Greece (Figure 1A). It is likely that the small number of sites in south and east Europe is due to a lack of literary resources and not to the natural absence of beetles in these countries. Occurrences in Latvia and Macedonia have been reported but without designation of the specific locality [67].

Although P. rhododactylus occurs throughout Europe (Figure 2A) [67], it appears to be a Euro-Mediterranean species [68]. It is also widespread in non-European countries, such as Algeria, Egypt, Libya, Morocco, Madeira, Tunisia, and Iran [67]. Its abundance is highest Western Europe and decreases to the north and east. Its current distribution (Figure 1A) appears to be similar to that reported in 1955 [15].

The range of P. rhododactylus matches that of its main host, C. scoparius. C. scoparius is adapted to milder climates and its range is limited by cold winter temperatures. Although adult plants are relatively hardy, the seeds, seedlings, and young shoots of C. scoparius are sensitive to frost [69][70][71]. Its occurrence to the east (Russia and Ukraine) is sporadic [72].

C.scoparius has become an ecologically destructive invasive species in grasslands, shrublands, woodlands, and other habitats in India, South America, western North America, Australia, and New Zealand [73]. P. rhododactylus has not been found in any of the areas invaded by C. scoparius [3][74].

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Figure 1. Localities (or countries and counties) where *Phloeotribus rhododactylus* has been reported to occur in Europe with annual mean temperature (**A**) (see Table 1); periods of its first reports in countries (**B**); occurrence of *Phloeotribus rhododactylus* with Cytisus scoparius in the Czech Republic (https://portal.nature.cz/nd/) (**C**,**D**) in a recent study in western Bohemia, reported here (List of localities where *Phloeotribus rhododactylus* was not found in the study conducted by T. Fiala in 2020 in western Bohemia: Bečov na Teplou (50.0858942 N, 12.8625314 E); Blovice (49.5961411 N, 13.5222964 E); Dolní Žandov (50.0175272 N, 12.5845317 E); Dolní Žandov—Manský dvůr (50.0356972 N, 12.5319819 E); Kfely (50.1607864 N, 12.8421089 E); Mariánské Lázně (49.9555339 N, 12.6991647 E), NR Lazurový vrch (49.9135836 N, 12.7724494 E); NR Údolí Teplé (50.0554547 N, 12.8287328 E); Valy (49.9824786 N, 12.6813111 E); Vodná (50.1106978 N, 12.8631644 E)). NR—Natural Reserve.

3. Conclusions

Phloeotribus rhododactylus seems to have a stable range that is centred in Western Europe and extends to Eastern Europe. Its abundance is highest in Western Europe and decreases to the east, which coincides with the distribution of the host tree, C. scoparius. P. rhododactylus is a rare species in Central Europe. It occupies trees or shrubs that have been damaged or that are drought-stressed. It is possible that weak pheromone communication and weak interactions with fungi also contribute to its rare occurrence.

As is the case for abundance of most bark beetles [14], the abundance of P. rhododactylus can apparently be explained by resource-related parameters.

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