much better. After all, I think the result is a decided success. All the so-called pure rubber stoppers for chemical laboratories of American make are, as far as I am able to ascertain, manufactured of vulcanized rubber, which is not the case with those imported from Germany. The Professor of the chemical laboratory here has had the same experience. The 7,800 stoppers of different sizes have cost about \$110; if they had been bought at once at wholesale figures, the price would have been 30 to 35 per cent. less.

As the stock in hand for the advancement of the collection has to be a large one, I may draw attention to a method recommended by Prof. W. Hempel, of Dresden, Saxony, to prevent the stoppers becoming too hard (Bericht d. Deutsch. Chem. Gesell., 1882, vol. xv., Heft. 6, No. 184). Rubber stoppers or tubes retaining their elasticity should be kept in large glass jars, in which an open vessel with petroleum has been placed. It is better to keep the light from the jar; wooden boxes should not be used. Stoppers which have become hard should be brought together in a jar with sulphuret of carbon until they are softened, and afterwards be kept in a jar with petroleum just as the others. Before knowing this I used to soften such stoppers by squeezing in different directions, or by rolling with a piece of board. Of course Prof. Hempel's method is better, as it prevents the gradual evaporation of the fluids used for the solution of the rubber in the process of vulcanization. It is remarkable that until now none of the stoppers in the vials arranged in wooden boxes have become hardened, though the same stoppers not fixed in vials with alcohol grew hard. Probably the strong pressure of the alcohol by fitting the stoppers has some influence in keeping them soft; besides, the part of the stopper outside of the vial is mostly small. I do not know whether rubber stoppers for similar purposes have been used here or in Europe earlier than in the Cambridge Museum: if so, I would be very glad to know the results obtained elsewhere.

PRELIMINARY LIST OF THE SPECIES OF ACARINA OF NORTH AMERICA.

BY HERBERT OSBORN, OF THE IOWA AGRICULTURAL COLLEGE, AND
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The Acarina, especially the more minute forms, have been but little studied in America, a fact which seems the more strange when we con-

sider what interesting objects they form for microscopic work. As in most groups of Arthropoda, the pioneer work in this country was done by Thomas Say, whose descriptions of a number of the larger species appeared as early as 1821. Later on Dana and Whelpley (1836), and Haldeman (1842), contributed descriptions of a few species. More recently Dr's. Fitch, Leidy, Packard, Riley, LeBaron and Shimer, and Mr. Ashmead, have published descriptions of species and notes on habits, while quite lately Mr. Harry Garman has published a valuable paper on the Phytoptidæ, which it is hoped he will follow up by still more extensive study of this family.

It is hoped that the following list of the Acarina of the United States and Canada—which we have made as complete as possible up to date—may encourage the further study of the group, and as an additional aid it may be in place to make a few statements concerning their habits and the methods of studying them.

The Trombididæ are found on plants or free as adults, frequently in the larval form, as parasites on insects. The Hydrachnidæ are aquatic, and probably many interesting parasitic forms will be found by careful examination of the gills of bivalve mollusks. Of the Gamasidæ occurring as parasites on insects but few of the probable number have yet been described. In the Acaridæ we have many parasitic forms on birds and mammals, and here especial care should be taken to identify with described European forms whenever possible, particularly in all cases where the bird or mammal host is identical in the two countries. Doubtless many described species occur commonly here which have never been recorded, e. g. *Myobia musculi* seems never to have been recorded in America, but has been taken at Ames, Iowa, and hence is included in our list. A few species common to domesticated animals that are being constantly imported from other countries have been included in this list, even when we have been unable to find a positive record of their occurrence here.

The Phytoptidæ are microscopic in size, and occur on buds, leaves and fruits, producing galls, deformations, blisters or rusts, and their study offers an almost unlimited field for careful investigation.

A large proportion of the mites are too small to be readily studied or preserved, except as microscopic objects, and the most desirable method is to mount them at once, or as soon after collecting as possible, in glycerine jelly or prepared balsam. It is frequently a great advantage to

examine them carefully with the microscope while still alive and moving.

The American literature on this subject, besides being quite scanty, is widely scattered, and some of the papers now quite difficult to procure.

Family TROMBIDIDÆ Leach.

I. *Tetranychus* Dufour.

- 1—T. TELARIUS Linn. Packard, Guide to Study of Insects, 660; Murray, Economic Entom., 97*; Saunders, Can. Ent. xii, 237* (1880); Insects Inj. to Fruit, 355* (1883); Ontario Entom. Rep., xi, 70* (1880); Forbes, Ill. Rep., xiii, 106 (1884); Standard Nat. Hist. ii., 103.

II. *Trombidium* Fab.

- 1—T. PARASITICUM Murray. Economic Entom., 129* (1877); Ont. Entom. Rep., xi, 71 (1880).
Atoma parasiticum, Latr. (1806). Riley, Mo. Rep., vii, 176* (1875).
Trombidium muscarum, Riley. First Rep. U. S. Entom. Com. 306-311 (1878).
 2—T. SERICEUM Say. Jour. Phila. Acad. ii., 70 (1821); Coll. Writings ii., 16; Riley, Mo. Rep. vii., 175* (1875), et. Supp., 63; Murray, Economic Entom. 138* (1877); Ont. Entom. Rep. xi., 72 (1880).
 3—T. GRYLLARIUM Murray. Economic Entom. 136* (1877).
Atoma gryllaria, LeBaron. Ill. Rep. ii., 61* (1871).
 4—T. SCABRUM Say. Jour. Phila. Acad. ii., 69 (1821); Coll. Writings ii., 16; Riley, Mo. Rep. vii, 175 (1875).
 5—T. GIGANTEUM Riley. First Rep. U. S. Entom. Com., 312 (1878).
 6—T. BULBIPES Packard. Mass. Rep. iii., 26* (1873); Murray, Economic Entom. 136*; Ont. Ent. Rep. xi, 71.

LARVAL FORMS INCERTIS SEDÆ.

- 1—LEPTUS (*Trombidium* ?) AMERICANUS Riley, Mo. Rep. vi, 122 (1874); Murray, Economic Entom., 116.*
 2—LEPTUS (*Trombidium* ?) ARANÆ Say, Jour. Phila. Acad. ii., 80 (1821); Coll. Writings ii., 23.
 3—LEPTUS (*Trombidium* ?) HISPUS Say, Jour. Phila. Acad. ii., 81 (1821); Coll. Writings ii., 23.
 4—LEPTUS (*Trombidium* ?) IRRITANS Riley, Mo. Rep. vi., 122 (1874); Murray, Economic Entom., 116*; Ontario Entom. Rep. xi., 71.

* A star indicates an illustration at the reference marked.

- 5—OCYPETE (*Trombidium* ?) COMATA Say, Jour. Phila. Acad. ii., 82 (1821); Coll. Writings, ii., 23.

III. *Erythræus* Latr.

- 1—E. MAMILLATUS Say, Jour. Phila. Acad. ii., 70 (1821); Coll. Writings ii., 16.

Family BDELLIDÆ Duges.

I. *Bdella* Latr.

- 1—B. MARINA Packard, 1st Rep. U. S. Fish Com., 544 (1874); Guide to Study of Insects, 660; Am. Nat. xviii., 827* (1884); Standard Nat. Hist., ii., 103.
2—B. OBLONGA Say, Jour. Phila. Acad. ii., 74 (1821); Coll. Writings, ii., 19.

Family HYDRACHNIDÆ Sundeval.

I. *Limnochares* Latr.

- 1—L. EXTENDENS Say, Jour. Phila. Acad. ii., 80 (1821); Coll. Writings ii., 22.

II. *Hydrachna* Müller.

- 1—H. COCCINNEA Haldeman, Proc. Phila. Acad. i., 196 (1842).
2—H. FORMOSA Dana & Whelpley, Am. Jour. Science, 1st ser., xxx., 357* (1836).
3—H. NEBULOSA Haldeman, Proc. Phila. Acad., i., 196 (1842).
4—H. PYRIFORMIS Dana & Whelpley, Am. Jour. Science, 1st ser., xxx., 358* (1836).
5—H. 5-UNDATA Haldeman, Proc. Phila. Acad., i., 184 (1842).
6—H. SCABRA Haldeman, Proc. Phila. Acad. i., 184 (1842).
7—H. TRIANGULARIS Say, Jour. Phila. Acad. ii., 79 (1821); Coll. Writings ii., 23.
8—H. TRICOLOR Packard, Am. Jour. Science, 3rd ser., i., 108 (1871).
9—H. BELOSTOMÆ Riley, 1st Rep. U. S. Entom. Com., 312* (1878).

III. *Atax* Fab.

- 1—A. HUMEROSA. Standard Nat. Hist. ii., 102. Where described?
2—A. YPSILOPHORUS. Standard Nat. Hist. ii., 102. Where described?

IV. *Thalassarachna* Packard.

- 1—T. VERRILLII Packard. Am. Jour. Science, 3rd ser., i., 107 (1871); Standard Nat. Hist. ii., 102. Referred by Murray to *Pontarachna*.

Family GAMASIDÆ Leach.I. *Sejus* Koch.

- 1—*S. AURIS* Murray, Economic Entomology, 167 (1877).
Gamasus auris Leidy, Proc. Phila. Acad., 1872, 138.

II. *Dermanyssus* Duges.

- 1—*D. AVIUM* Duges —. Murray, Economic Entom., 169*; Ont. Entom. Rep. xi., 73.

III. *Gamasus* Latr.

- 1—*G. ANTENNÆPES* Say, Jour. Phila. Acad. ii., 71 (1821); Coll. Writings ii., 17.
 2—*G. COLEOPTRATORUM* Latr. —; Packard, Guide to Study of Insects, 663; Murray, Economic Entom., 158*.
 3—*G. JULOIDES* Say, Jour. Phila. Acad. ii., 72 (1821); Coll. Writings ii., 18.
 4—*G. MUSCULUS* Say, Jour. Phila. Acad. ii., 72 (1821); Coll. Writings ii., 17.
 5—*G. NIDULARIUS* Say, Jour. Phila. Acad. ii., 72 (1821); Coll. Writings ii., 17.
 6—*G. SPINIPES* Say, Jour. Phila. Acad. ii., 71 (1821); Coll. Writings ii., 17.

IV. *Argas* Latr.

- 1—*A. AMERICANA* Packard, Rep. U. S. Geol. Survey of Montana, Idaho, Wyoming and Utah (Hayden) 740* (1872); Murray, Economic Entom., 182.

V. *Uropoda* Latr.

- 1—*U. AMERICANA* Riley, Proc. A. A. A. S. xxv., 273-275* (1877); Mo. Rep. ix., 41 (1877); Standard Nat. Hist. ii., 102.
 2—*U. VEGETANS* DeGeer. —; Packard, Guide to Study of Insects, 663; Murray, Economic Entom., 162*.

*Family IXODIDÆ.*I. *Ixodes* Latr.

- 1—*I. ALBIPICTUS* Packard, Am. Nat. ii., 559* (1868); 1st Ann. Rep. Peabody Acad. Science, 65 (1869); Am. Nat. iii., 365 (1869); Guide to Study of Insects, 662*; Standard Nat. Hist. ii., 100*.
 2—*I. AMERICANUS* Latr. —. Fitch, N. Y. Rep. xiv., 363 (1871).
 3—*I. ANNULATUS* Say, Jour. Phila. Acad. ii., 75 (1821); Coll. Writings ii., 19.

- 4—I. BOVIS Riley, Packard, 1st Ann. Rep. Peabody Acad. Science, 68 (1869); Rep. U. S. Geol. Survey of Montana, Wyoming and Idaho (Hayden) 740* (1872); Guide to Study of Insects, 663, 668*; Murray, Economic Entom., 193; Osborn, Bull. Iowa Agr. Coll., 75 (1884).
- 5—I. CHORDEILIS Packard, 1st Ann. Rep. Peabody Acad. Sci., 67 (1869).
- 6—I. COOKEI Packard, 1st Ann. Rep. Peabody Acad. Sci., 67 (1869).
- 7—I. CRENATUS Say, Jour. Phila. Acad. ii., 76 (1821); Coll. Writings ii., 20.
- 8—I. CRUCIARIUS Fitch, N. Y. Rep. xiv., 366 (1871).
- 9—I. ERRATICUS Say, Jour. Phila. Acad. ii., 77 (1821); Coll. Writings ii., 20.
- 10—I. FUSCUS Say, Jour. Phila. Acad. ii., 79 (1821); Coll. Writings ii., 22.
- 11—I. LEPORIS-PALUSTRIS Packard, 1st Annual Rep. Peabody Acad. Science, 67 (1869).
- 12—I. NIGROLINEATUS Packard, 1st Ann. Rep. Peabody Acad. Science, 66 (1869).
- 13—I. ODONTALGIÆ Fitch, N. Y. Rep. xiv., 371 (1871).
- 14—I. ORBICULATUS Say, Jour. Phila. Acad. ii., 76 (1821); Coll. Writings ii., 21.
- 15—I. PUNCTULATUS Say, Jour. Phila. Acad. ii., 78 (1821); Coll. Writings ii., 21.
- 16—I. 5-STRIATUS Fitch, N. Y. Rep. xiv., 366 (1871).
- 17—I. ROBERTSONII Fitch, N. Y. Rep. xiv., 366 (1871).
- 18—I. SCAPULARIS Say, Jour. Phila. Acad. ii., 78 (1821); Coll. Writings ii., 21.
- 19—I. UNIPUNCTATA Packard, 1st Ann. Rep. Peabody Acad. Science, 66 (1869); Guide to Study of Insects, 662, 668.*
- 20—I. VARIABILIS Say, Jour. Phila. Acad. ii., 77 (1821); Coll. Writings ii. 21.

Family ORIBATIDÆ Nicolet.

I. *Oribata* Latr.

- 1—O. ASPIDIOTI Ashmead, Can. Entom. xi., 93 (1879); Saunders, Insects Inj. to Fruit, 396 (1883).
- 2—O. CONCENTRICA Say, Jour. Phila. Acad. ii., 73 (1821); Coll. Writings ii. 18.
- 3—O. GLABRATA Say, Jour. Phila. Acad. ii., 73 (1821); Coll. Writings ii., 18.
- 4—O. QUADRIPILIS Fitch, N. Y. Rep. iii., 442 (1856).

II. *Nothrus* Koch.

- 1—N. OVIVORUS Packard, Guide to Study of Insects, 664,* Riley, Mo.

Rep. ii., 102 (1870); 3rd Rep. U. S. Entom. Com., 175* (1883); Standard Nat. History, ii., 102*.

III. *Hoplophora* Koch.

- 1—H. ARCTATA Riley, Mo. Rep. vi., 53, 81 (1874); Murray, Economic Entom., 225*; Saunders, Insects Injurious to Fruit, 239* (1883); Ontario Entom. Rep., xiii., 66; Standard Nat. Hist. ii., 102*.

Family ACARIDÆ.

I. *Tyroglyphus* Latr.

- 1—T. MYCOPHAGUS Megnin. Jour. Anat. Phys. (1874)*; Ontario Entom. Rep. xi., 73*.
Rhizoglyphus mycophagus Murray, Economic Entom., 262*.
- 2—T. PHYLOXERÆ Riley, Mo. Rep. vi., 52, 53, 81 (1874); Saunders, Can. Ent. xiv., 127* (1882); Insects Inj. to Fruit, 239* (1883); Ontario Entom. Rep. v., 61; xiii., 66; Standard Nat. Hist. ii., 100.
Rhizoglyphus phylloxeræ Murray, Economic Entom., 258*.
- 3—T. ENTOMOPHAGUS Laboul., Ann. Soc. Ent. Fr. (1862); Murray, Economic Entom., 263; Ontario Entom. Rep., xi., 73.
- 4—T. SIRO Latr.—(*Acarus siro* L., *Tyroglyphus farinæ*, *T. sacchari* Auct.) Packard, Guide to Study of Insects, 665; Murray, Economic Entom., 267*; Saunders, Can. Ent., xii., 237* (1880); Ontario Entom. Rep., xi., 74.
- 5—T. GLOVERI Ashmead, Amer. Entomologist, new series, I., 106 (1880); Saunders, Insects Injurious to Fruit, 391 (1883).
Acarus ? Gloveri Ashmead, Can. Ent., xi., 159 (1879).
- 6—T. LONGIOR Gervais (1844); Am. Nat. xvi., 599; Murray, Economic Entom., 267*; Ontario Entom. Rep., xi., 74.
- 7—T. MALUS Riley, Mo. Rep. v., 87* (1873); Murray, Economic Entom. 275*; Ontario Entom. Rep. xi., 74*; Osborn, Bull. Iowa Agric. Coll. 59 (1884).
Acarus ? malus Shimer, Trans. Am. Entom. Soc., i., 368 (1868).
- 8—T. RIBIS Fitch, N. Y. Rep. iii., 424 (1856).
- 9—T. ACERIS.
Acarus aceris Shimer, Trans. Am. Entom. Soc., ii., 320 (1869).

II. *Cheyletus* Latr.

- 1—C. SEMINIVORUS Packard, Guide to Study of Insects, 665, 668*.

III. *Sarcoptes* Latr.

- 1—S. CATI Hering & Gerlach — ; Murray, Economic Entom., 302; Osborn, Bull. Iowa Agric. Coll. 76 (1884).
- 2—S. MUTANS Robin & Lang, Comptes-Rendus xlix. (1859); Murray, Economic Entom. 305*; Osborn, Bull. Iowa Agric. Coll., ii., 76.
- 3—S. SCABIEI Latr.—; Murray, Economic Entom., 292*; Packard, Guide to Study of Insects, 666; Ontario Entom. Rep. xi., 75*; Osborn, Bull. Iowa Agric. Coll. 76 (1884); Standard Nat. Hist. ii., 100*.

IV. *Psoroptes* Gerv.

- 1—P. EQUI Gervais, Ann. Soc. Nat. (1841); Murray, Economic Entom., 308*; Packard, Guide to Study of Insects, 666; Osborn, Bull. Iowa Agric. Coll. 76 (1884).
- Dermatodectes equi* Gerl., *D. bovis* Gerl., *D. ovis* Gerl., *Dermatokoptes communis* Furst.

V. *Symbiotes* Gerl.

- 1—S. BOVIS Gerlach — ; Murray, Economic Entom. 313*; Osborn, Bull. Iowa Agric. Coll. 76 (1884).
- Sarcoptes bovis* Hering, *Chorioptes caprae* Gerv., *Symbiotes equi* Gerl., *Sarcodermatodectes caprae* Delaf. & Bour., *Dermatophagus bovis* Furst.

VII. *Myobia* Claparede.

- 1—M. MUSCULI Schrank — ; Murray, Economic Entom., 315*.

VIII. *Pterolichus* Robin.

- 1—P. FALCIGER Megnin.— Garman, Am. Nat., xviii., 430* (1884).

IX. *Dermaleichus* Koch.

- 1—D. PICI-PUBESCENTIS Packard, Am. Nat. iii., 493, plate vi., figs. 1, 2, 3 (1869); Guide to Study of Insects, 666; Weed., Am. Nat. xviii., 633 (1884).

X. *Cytoleichus*.

- 1—C. SARCOPTOIDES Megnin, Am. Nat. xvii., 422 (1883).

XI. *Demodex* Simon.

- 1—D. FOLLICULORUM Simon — ; Murray, Economic Entom., 329*; Packard, Guide to Study of Insects, 667; Faxon, Bull. Museum Comp. Zool. v., No. 2*; Standard Nat. Hist., ii., 100*.
- 2—D. PHYLLOIDES Csokor. Verhandl. der K. K. Zool-bot. Gesell. in Wien., xxix., 419 (1879); Am. Nat. xvi., 1009 (1882); xvii., 1113 (1883).

XII. *Phytoptus* Dujardin.

- 1—P. ABNORMIS Garman. Appendix to Ill. Rep. xii., 134 (1883).
- 2—P. ACERICOLA Garman. Appendix to Ill. Rep. xii., 135 (1883).
- 3—P. FRAXINI Garman. Appendix to Ill. Rep. xii., 136 (1883).
- 4—P. OLEIVORUS (Ashmead).—Hubbard, Rep. U. S. Entom. 1884, 363-373*.
Typhlodromus oliivorus Ashmead, Can. Ent., 160 (1879).
- 5—P. QUADRIPIES Garman. Appendix to Ill. Rep. xii., 132*, 135 (1883); Osborn, Bull. Iowa Agric. Coll., 57 (1884).
Vasates quadripes Shimer, Trans. Am. Entom. Soc. ii., 319 (1869).
- 6—P. QUERCI Garman. Appendix to Ill. Rep. xii., 138 (1883).
- 7—P. PYRI Murray, Economic Entom., 340*, 358 (1877); Garman, Appendix to Ill. Rep. xii., 140 (1883); Osborn, Bull. Iowa Agric. Coll. 56 (1884).
Typhlodromus pyri Scheuten, Wiegman's Archiv. (1857); Packard, Guide to Study of Insects, 666, 668*.
- 8—P. SALICOLA Garman, Appendix to Ill. Rep., xii., 138 (1883).
- 9—P. THUJÆ Garman, Appendix to Ill. Rep., xii., 138* (1883).
- 10—P. ULMI Garman, Appendix to Ill. Rep., xii., 136 (1883).

INCERTIS SEDÆ.

- 1—HYPOPUS CONCOLOR Hald., in Terrestrial Air Breathing Mollusks of the U. S. (Binney), ii., 107.
- 2—ACARUS? SEMEN Walsh, Proc. Am. Entom. Soc., iii., 606.
- 3—ACARUS? ÆNIGMA Walsh, Proc. Am. Entom. Soc., iii., 608.

ELAPHIDION PARALLELUM, NEWM., AND PHYMATODES VARIABILIS, FAB.

BY C. H. T. TOWNSEND, CONSTANTINE, MICH.

In the Oct. number of this journal I noticed with interest the article by Mr. Clarkson on *Elaphidion villosum*, Fabr. I have reason to believe that the same is partly the case also with *E. parallelum*, Newm., which I find to be the common oak-pruner here. But I do not agree that it is always, or even in the majority of instances, the case with either species.